

Department of Agriculture, C. P.

REPORT

ON THE

NAGPUR EXPERIMENTAL FARM

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FOR THE YEAR 1898-99

Ending 31st March, 1899.

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FROM

R. H. CRADDOCK, ESQ., I.C.S.,

OFFG. COMMISSIONER OF SETTLEMENTS & AGRICULTURE,

Central Provinces,

TO

THE SECOND SECRETARY TO THE CHIEF COMMISSIONER,

REVENUE DEPARTMENT,

Central Provinces.

Dated 28th September 1899.

SIR,

I HAVE the honour to submit the Report on the working of the Nagpur Experimental Farm for the year 1898-99. An inspection note of the Farm by Dr. Leather is attached to the Report as Annexure F.

2. The rainfall up to the middle of September was considerably in excess of the normal, but after that date there was no rain worth mentioning, and the cold weather months were quite dry, a shower in February being too late to be of any practical use. Kharif crops gave good outturns, but the cold weather til was much damaged by downpours of rain in the first week of September, and all the cold weather crops suffered severely from drought, and returned very poor yields. Some of our most important experiments are conducted with wheat and linseed, and the dry conditions of the last four successive years have greatly vitiated the results obtained.

3. Effective manuring for wheat is one of the great requirements of the Province. The people usually lavish their supply of manure on rice and kharif crops, leaving wheat to shift for itself on such plant food as the black soil can supply. The reason for this is that manure is better assimilated by crops grown in the rains, moisture being essential to the absorption by the plant of the beneficial constituents of the manure. This is well brought out by the differences in the yields of wheat manured when irrigated and unirrigated respectively. In the irrigated plots the best manure, cattle-dung, gave a yield over the unmanured plot of 1,189:282. While in the unirrigated series the corresponding yields were 279:107. The result of the long series of experiments, the oldest on the Farm, is to establish the superiority of nitrogenous manures over other kinds. It is also clear that in dry seasons the application of cow-dung alone to unirrigated wheat encourages the depredations of white-ants, and that green-manuring is in such seasons of very little advantage, although with irrigation it gives a moderate increase in the yield.

4. As regards saltpetre, the results obtained in fields 23 and 68 (page 6 of the Report) indicate that a light top-dressing with saltpetre is preferable to using larger quantities, and if the same results continue for a few years, it will be advisable to make this alteration in the plots of the A. and B. series also.

5. Another experiment, which has the same object in view, is that conducted in fields 15 and 55 to test the proper time for manuring fields for wheat. If the field is manured in June it is likely that a great deal of the valuable constituents are washed out before the cold weather. It is hoped, therefore, that manuring in August will give better results. Both years have, however, been too dry for the success of the late manuring, for which rain in late September and early October is essential. The experiment will be continued.

6. No experiments which require linseed to be sown year after year on the same plot can ever succeed, and all such will be dropped; but the experiment (page 9 of the Report) with phosphatic manures on various oil-seeds in rotation suggested by Dr. Leather will be continued.

7. One of the most practical experiments on the Farm is that of manuring with fresh sewage on the plan devised by Lieutenant Meagher of Allahabad. This experiment has formed the subject of recent reports. The yields of jwar which it gave were phenomenal, nearly 3,000lbs. of grain to the acre, and the cotton crops picked on the fields so manured were bumper ones. If extended to all Municipal areas it should

enable large crops to be grown in their vicinity and give Municipal Committees some income from the disposal of sewage. The experiment has been tried with success at Deoli in Wardha, and by the Secretary, Municipal Committee, Nagpur. I propose to have a brief bulletin drawn up giving an exact description of the method followed, and the results at present obtained, and to circulate this to all districts with a view to the system being everywhere tried. It is simplicity itself, the fresh excrement is deposited in very shallow furrows and covered up with a very light covering of earth. The best time for the spreading of the sewage is between February and May.

8. The rotation experiments dealt with in Sections IV and V of the Report and the experiments with crop mixtures dealt with in Section VI call for no special notice. They are interesting as testing the practices of the country, but we are not likely to be able to teach the people much in the matter of rotation of the crops usually grown. It is of all agricultural matters the one in which the experience of many generations, even of the most ignorant cultivators, is likely to produce a better knowledge than the comparatively ephemeral experiments conducted on the Farm. The rotation experiments with manure, however, afford a useful variation on the simple manure experiments, and seem to indicate that manuring is more efficacious when accompanied by rotations.

9. The experiment under tillage (Section VII) to test the effect of deep ploughing has been duplicated as was suggested a few years back. On the old plot the experiment continued to show year after year that ploughing and *bakharing* (i.e., scarifying with a hoe-plough) in alternate years gave the best results. In the new plot this is not confirmed, and it is probable that there is unevenness in the fertility of the land which is vitiating the experiment. Time will show this, and the results will be watched for another year or two.

10. The introduction into the country of new varieties of crops is distinctly a direction in which much practical good can be done: and a small amount of distribution of seed has been carried out. (See also Section XII of the Report.) This portion of the work done has been relegated to a rather subsidiary position, and I should like to see it being given a more important place both in the operations of the Farm as well as in the Report. We have recently given *juar* seed, sufficient to sow 160 acres, to the tenants of the village of Somalwara, 5 miles south of Nagpur. The *juar* in that village was heavily smutted, and we have taken smutted seed in exchange for our pure seed, selling the former for what it is worth in the local market. A circular regarding the treatment of *juar* seed with sulphate of copper to prevent smut was distributed among the Land Record staff, but I have not yet heard whether anyone has been induced to try the remedy.

11. The other heads of the Report require no detailed notice, but I would mention in regard to the Sewage Farm that arrangements were concluded by Mr. Carey by which the rents received from the Kachi settlement will, in future, cover the expenses entailed on Government in supplying them with manure and water. The leases of the fields of the old Model Farm were renewed at the close of the year, some little reduction being found necessary owing to the inferior crops of the past few seasons.

12. The Agricultural Class is filling better than for some years past, and several of the students come from the north of the Province. The best student of the junior class was a Kurmi of Hoshangabad.

13. The net cost of the Farm was Rs.3,340, as compared with Rs.4,146 in the previous year. The receipts were almost the same, but the expenditure was less. The Telinkheri Reserve continues to pay its way by its supply of grass, though in the absence of a good water-supply tree planting over most of its area is difficult, and in some parts almost impossible.

14. Many of the suggestions contained in Dr. Leather's Note of Inspection (Annexure F. of the Report) have received or are receiving consideration; and as already stated, more attention will now be paid to the cultivation of additional varieties and the distribution of good seed. But I must to some extent join issue with Dr. Leather as to the remarks contained in para. 18 of his Note. He considers the site unsuited for an experimental farm and recommends that wheat cultivation be abandoned, and the fields devoted to kharif crops for some time to come. In making these comments Dr. Leather has entirely overlooked that an unirrigated farm (for but a very small area is irrigable) is liable to suffer from the climatic conditions which affect the country. The small yields of wheat reaped of late years are due not to exhaustion of soil, but to failure of the wheat crop, first owing to excessive rain and moist heat producing rust which damaged the wheat crop for the years 1892-93 to 1894-95, and subsequently to persistent drought during the autumn and cold weather. These adverse conditions have been common to the Nagpur country and in fact to the whole Province. A farm in Jubbulpore, for instance, would be more valuable for experiments in wheat, but it would be of little service for the cultivation of such crops as *juar* and cotton. In Nagpur we are on the borders of a wheat, cotton-*juar* and

rice country, while linseed and til are among our principal crops. Were it possible to establish farms in several parts of the Province we might select sites far more suitable for the growth of each of these various crops, but we should have to travel far before we could find a locality in which, ample supervision being possible, the soil was capable of producing with fair success all the different crops named.

15. I may add, however, that since Dr. Leather's visit, the Agricultural Department has taken over the management of the Telinkheri garden and farm lands attached to it which were formerly under the charge of the Forest Department. This gives us some very excellent land, of which a good deal is irrigable, some fine rice land, as well as land capable of producing wheat and cotton ; and I propose to lay out a scheme of experiments in rice cultivation to test and compare the relative efficacy of the various diverse systems of rice cultivation followed in different districts of the Province.

16. I have only to add in conclusion, that Mr. Joshi continues to supervise the Farm with the same skill and ability that he has always shown, and that he has entered upon the charge of the new area entrusted to him at Telinkheri with his wonted zeal and enthusiasm. For the better utilization of the services of our students in the interests of agricultural improvement I will submit separate representations later on. One of our former students, Mr. Jiya Lal, makes an excellent Farm Overseer under Mr. Joshi's supervision.

I have the honour to be,

SIR,

Your most obedient Servant,

R. H. CRADDOCK,

Offg. Commissioner of Settlements and Agriculture.

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FROM

THE SUPERINTENDENT,

GOVERNMENT EXPERIMENTAL FARM,

Nagpur,

To

THE COMMISSIONER OF SETTLEMENTS AND AGRICULTURE,

Central Provinces.

SUBJECT :

Report on the Nagpur
Experimental Farm for the
year 1898-99.

Dated Nagpur, the 26th June 1899.

SIR,

I HAVE the honour to submit the Fifteenth Annual Report on the working of the Experimental Farm, Nagpur, for the year ending 31st March 1899.

2. The arrangement of the present report is the same as that adopted last year.

I.—HISTORY OF THE FARM.

3. The Nagpur Experimental Farm was established in 1883, in which year the former Model Farm was given up and the present site selected in its stead. The land is close to Nagpur and is moderately typical of the soil which is to be found in the Central Provinces. It consists of a fairly level piece of land of about 90 aeres in extent, out of which about 70 acres are under cultivation, the rest being occupied by roads, buildings and waste land. The soil is of the black-cotton type, but somewhat inferior. It varies in depth from 4 to 10 feet, and is situated upon gneiss rock. The natural drainage is however bad, and kharif crops frequently suffer in consequence. The road to Ambajheri which intersects the Farm, acts as a sort of embankment to hold up the water.

New drains were opened in 1896, but they have not improved the drainage of the Farm as much as could be desired.

II.—CHARACTER OF THE SEASON.

4. The following table compares the rainfall of the year as registered on the Farm with the average of the preceding twenty-four years:—

Rainfall, 1898-99.

Month.	No. of rainy days.	Rainfall.	Average of twenty-four years preceding.	Month.	No. of rainy days.	Rainfall.	Average of twenty-four years preceding.
		Inches.	Inches.			Inches.	Inches.
				Brought forward ...	47	47'62	44'44.
April { 1st half...	...	...	'14	October { 1st half...	1	'13	1'37
{ 2nd half...	1	'77	'24	{ 2nd half...	...	...	1'44
May { 1st half...	1	'19	'23	November { 1st half...	...	...	'70
{ 2nd half...	...	...	'26	{ 2nd half...	...	...	'20
June { 1st half...	7	3'01	2'94	December { 1st half...	...	'04	'12
{ 2nd half...	5	3'00	5'27	{ 2nd half...	...	...	'30
July { 1st half...	10	6'54	7'04	January { 1st half...	...	...	'37
{ 2nd half...	6	12'99	7'57	{ 2nd half...	...	...	'23
August { 1st half...	4	3'55	6'75	February { 1st half...	1	'27	'21
{ 2nd half...	6	8'27	5'10	{ 2nd half...	...	...	'24
September { 1st half...	5	8'71	4'62	March { 1st half...	...	...	'23
{ 2nd half...	2	'59	4'28	{ 2nd half...	...	...	'21
Total carried over ...	47	47'62	44'44	GRAND TOTAL ...	49	48'06	50'06

NOTE.—A rainy day is taken as one on which there was a fall of not less than 10 cents.

5. The rainfall of the year under report was 8 inches in excess of that of the preceding year, but in its distribution it was on the whole similar to that of 1897-98. The *khari*f crops succeeded well, but the outturns of the rabi crops were only half of the average. Cotton and tur sowings were effected in excellent time, but the germination of cotton was impeded by the absence of rain from the 19th to the 29th of June, and it was necessary to fill up the gaps occasioned by defective germination. The heavy rainfall of the 22nd July which amounted to 8.91 inches submerged the low-lying portions of the fields, and both the streams, *vis.*, the Ambajheri and Nagnaddi, in the delta of which the farm is situated, overflowed their banks. The consequence was that the rice crops in many low-lying plots was washed away. Resowing of the crop was out of the question, as the season had far advanced. Continuous rain in the same month impeded weeding operations by the *Daura* (bullock hoe), but the break of a week in the middle of August, *i.e.*, from 8th to 17th, allowed weeding operations to be continued uninterruptedly, and the crops showed signs of rapid improvement.

6. The rainfall of September was very favourable to the cotton, tur and juar crops. The sowings of cold season til (sesamum) were completed by the 1st of September, but the heavy showers which followed necessitated resowing. These again were damaged by further, though lighter, showers of rain. Germination was uneven, and the young plants were eaten in places by caterpillars. Those plants which survived did fairly well afterwards, but the outturn per acre was only 40 per cent. of normal.

7. October was rainless. The sowings of linseed were in progress up to the 6th of that month. Germination was good, but the soils began to dry very soon, and a large number of young seedlings succumbed to the drought during November and December. The latter month was singularly hot and cloudy, and the absence of the usual dews was much felt. The outturn of linseed was only 50 per cent. of the normal.

8. Wheat and gram sowings were commenced very early. Owing to the dry character of the season germination was most uneven. The cold-weather showers upon which the success of the rabi crops so largely depends, altogether failed. In the first fortnight of February there were a few showers of rain amounting to 0.27 which instead of proving beneficial to the standing crops did them slight injury by discolouring the ripened grain. The rainfall of the year under report was less than the average by two inches.

III.—MANURE EXPERIMENTS.

9. The different manures tried on the Farm fall into two classes, *viz.*, *natural* and *chemical*. The *natural* manures are :—

- | | |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Manure.</p> <p>(1) Box-dung.</p> <p>(2) Stall-dung.</p> <p>(3) Saltpetre.</p> <p>(4) Bone-dust.</p> | <p>(5) San-hemp (<i>Crotalaria juncea</i>) ploughed in green.</p> <p>(6) Bawachi (<i>Psorolia corilifolia</i>).</p> <p>(7) Ashes of cattle-dung.</p> |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

The *chemical* manures are :—

- | | |
|------------------------------------------------------------------|-------------------------------------------------------------|
| <p>(1) Ammonium chloride.</p> <p>(2) Calcium superphosphate.</p> | <p>(3) Potassium sulphate.</p> <p>(4) Calcium sulphate.</p> |
|------------------------------------------------------------------|-------------------------------------------------------------|

No description of *chemical* manures is necessary. That of the ordinary manures is given below :—

(1) *Box-dung*.—Box-dung is prepared in the Farm in the following manner: A pit measuring 10' × 10' and 2-6" deep is dug in the cattle-shed and is brick-lined on four sides. A pair of bullocks are tied in the pit, while the other bullocks are stalled in the cattle-shed. The excrements (urine and dung) of the former fall in the pit and the little straw that is left uneaten in the manger is spread over the excrements in the morning when the bullocks are let out either for work or for grazing. It takes generally from five to six months for the pit to be filled up to the top. The manure is then carted away and deposited in an ordinary pit dug in the ground for storing manure. These pits are covered over with straw to check evaporation, and are watered occasionally in the hot weather between March and June. The manure is not used until the lapse of one year from the date of deposit.

As this manure contains about one-half litter, the amount (*vis.*, 240 maunds) which is applied to an acre of land, is larger than the 160 maunds of stall-dung manure which would be put into an acre, since the stall-dung manure contains no litter.

(2) *Stall-dung*.—The term stall-dung is applied to dung collected from the cattle-shed from day to day and stored in an ordinary pit. This manure is also covered over with straw, and watered at intervals in the hot weather. It contains no urine, but only the solid excrements of the bullocks without straw.

(3) *Saltpetre*.—The saltpetre that is used on the Farm is crude saltpetre, obtained from Cawnpore through the Director of Land Records and Agriculture, North-Western Provinces

and Oudh. It is of two descriptions, black crude and white, which is a purer variety. The amount of saltpetre applied in the Farm is 240lbs. to the acre, and it is, as a rule, drilled in with the seed. A sample similar to that used in the year under report, was analysed by Dr. Leather in the year 1895-96. The results of that analysis were given in the Farm Report for that year.

(4) *Bone-dust*.—This manure is prepared in the following manner: bones of animals are ground in a mill, such as is usually used for grinding lime (chunam). They are then passed through a sieve, and the fine powder resulting is applied at the rate of 360lbs. to the acre, the method of application being the same as in the case of saltpetre.

(5) *San-hemp* (*Crotalaria juncea*) *ploughed in green*.—The seed of the hemp is sown broadcast at the beginning of the rains at the rate of 100lbs. per acre. On the 15th of August as the plants approach maturity, they are uprooted by hand and are buried in the furrows made by the Swedish plough. The plant san-hemp is one of the order *Leguminosæ* sub-division *papilionaceæ* which possesses the property of storing nitrogen from the atmosphere at their roots by the aid of nodules.

(6) *Bawachi* (*Psoralea corilifolia*).—This weed grows in abundance on the waste lands of the Farm. Being a papilionaceous weed, it possesses the property of storing nitrogen like san-hemp, hence it has been selected for the purpose of green manuring. These plants are raised and ploughed in just in the same fashion as has been described above in the case of hemp.

(7) *Ashes of Cattle-dung*.—Cattle-dung is collected and made into cakes, which, when dry, are burnt and reduced to ashes; 3,080lbs. are applied per acre.

10. Eleven experiments were carried on to test the comparative value of different manures or different methods of manuring. Perhaps the most important are those which are conducted on the two series of plots called A and B, in which wheat is annually manured with different materials, the only difference in the treatment being that the A series is irrigated, whilst the B series does not receive artificial irrigation. Series A was started fifteen years ago, series B, nine years ago.

In Fields Nos. 18 and 32 the effect of manuring wheat with a green crop ploughed into the land in August is compared with the outturn of land manured with cattle-dung. The effect also on the wheat crop of saltpetre is tested in fields Nos. 68 and 23, the former of which is irrigated.

In Fields Nos. 15 and 55 wheat is manured with cattle-dung, which is put on the land at different periods, two plots being manured in June and the other in August.

A series of plots are manured on the system devised by Mr. G. Ville, but for the last four years linseed cropping has been substituted for wheat.

In a series of plots lettered C, an experiment to test the effect of ordinary manures on a linseed crop is tried.

Lastly, in Fields Nos. 9 and 59, an experiment to test the effect of phosphatic manures on different oil-seeds, such as safflower (*Carthamus tinctorius*), til (*Sesamum*), linseed and mustard is tried. This is an experiment suggested by Dr. Leather—*vide* para. 3 of Annexure E to the Report for 1895-96.

Three fields were manured on the lines of the system initiated by Lieutenant Meagher, and were sown with juar and rice.

11. The results obtained in the case of each of these experiments during the year under report are tabulated in the following statements together with those of previous years, and such remarks as are deemed necessary are added in each case:—

SERIES A. SUBJECT.—*Effect on wheat grown continuously of different kinds of manures applied year after year with irrigation.*

Plot	I.—Area 0'10 acre.	Manured with saltpetre, 240lbs. per acre.
"	II. " 0'10 "	" bone-dust, 360lbs. per acre.
"	III. " 0'10 "	" saltpetre, 240lbs. and bone-dust, 360lbs. per acre.
"	IV. " 0'10 "	" cattle-dung, 160 maunds per acre.
"	V. " 0'10 "	" " 160 maunds and bone-dust, 360lbs. per acre.
"	VI. " 0'10 "	" ashes of 160 maunds cattle-dung per acre.
"	VII. " 0'10 "	Unmanured.
"	VIII. " 0'10 "	Green manured with san-hemp.

Commenced in 1890-91. Irrigated twice, once in December (3rd to 5th), and again in January (10th and 11th). Crop, wheat (haurp)—Nagpur.

No. of plot.	OUTTURN PER ACRE.											Cost of cultivation per acre.	Cost of manuring per acre.	COST OF IRRIGATION.		Gain in value on plot No. VII.	
	AVERAGE OF PRECEDING FIVE YEARS, 1890-91 to 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.					Labour.	Assumed water-rate per acre of watering		
Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.							
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
I ...	931	1,789	1,188	1,537	796	804	746	964	741	1,069	30 12 4	12 7 2	13 2 0	1 2 4	2 0 0	19 6 1	
II ...	626	954	765	835	391	469	551	869	459	461	18 5 3	11 14 10	3 6 0	1 2 4	2 0 0	6 15 0	
III ...	1,012	1,924	1,145	2,005	806	854	714	1,066	746	754	29 12 10	13 1 2	16 8 0	1 2 4	2 0 0	18 6 7	
IV ...	717	1,217	1,050	1,320	734	806	972	1,267	1,011	1,189	41 0 1	12 2 2	12 3 10	1 2 4	2 0 0	29 9 10	
V ...	739	1,343	1,294	1,706	778	792	761	1,039	987	1,003	39 7 3	15 6 8	15 9 10	1 2 4	2 0 0	28 1 0	
VI ...	584	915	754	1,074	560	600	656	664	546	554	21 13 1	12 2 2	11 6 6	1 2 4	2 0 0	10 6 10	
VII ...	486	820	517	702	316	344	355	405	282	318	11 6 3	12 2 2	...	1 2 4	2 0 0	...	
VIII ...	564	1,090	580	730	424	516	655	785	424	996	19 0 3	11 6 6	9 13 6	1 2 4	2 0 0	7 10 0	

NOTE.—The figures of average outturn from 1890-91 to 1896 are transferred from the B series.

The wheat was sown on the 21st October, and reaped on the 1st of March. The meteorological conditions of the last two years having been generally similar, the results and the conclusions to be drawn from them agree with those of last year. Plots Nos. IV and V which were manured with dung and dung and bone-dust respectively, have retained their positions, being first and second in the merit of outturns. Plot No. I manured with saltpetre and plot No. III, manured with saltpetre and bone-dust have changed places. Plot No. VI, manured with ashes and plot No. VII, unmanured, have shown no change. Last year the green manured plot showed better results than plot No. II, which was manured with bone-dust, but this year it again occupies its old position.

SERIES B. SUBJECT.—*Effect on wheat grown continuously of different kinds of manures applied year after year without irrigation.*

Plot	I.—Area 0'10 acre. Manured with saltpetre, 240lbs. per acre.
"	II. " 0'10 " " bone-dust, 360lbs. per acre.
"	III. " 0'10 " " saltpetre, 240lbs. and bone-dust, 360lbs. per acre.
"	IV. " 0'10 " " cattle-dung, 160 maunds per acre.
"	V. " 0'10 " " 160 maunds and bone-dust, 360lbs. per acre.
"	VI. " 0'10 " " ashes of 160 maunds dung per acre.
"	VII. " 0'10 " Unmanured.
"	VIII. " 0'10 " Green manured with san-hemp.
Commenced in 1884-1885. Unirrigated. Crop, wheat (haura)—Nagpur.	

No. of plot.	OUTTURN PER ACRE.													Cost of cultivation per acre.	Cost of manuring per acre.	Gain in value on plot No. VII.	
	AVERAGE OF FIVE YEARS, 1885—89.		AVERAGE OF PRECEDING FIVE YEARS, 1890—94.		1895-96.		1896-97.		1897-98.		1898-99.						
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.				
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.				
I	...	1,133	1,711	751	1,468	836	1,006	456	554	401	809	456	594	18 11 4	12 3 0	13 2 0	14 0 10
II	...	891	1,388	534	882	486	654	241	359	394	826	282	417	11 11 11	11 0 8	3 6 0	7 1 5
III	...	1,094	1,751	865	1,538	621	709	472	647	485	1,045	362	487	14 14 6	12 3 0	16 8 0	10 4 0
IV	...	913	1,520	627	1,393	532	678	286	464	286	604	279	521	12 0 4	12 2 2	12 9 8	7 5 10
V	...	953	1,415	666	1,224	632	729	374	576	502	1,147	625	1,025	26 6 7	12 2 2	15 15 8	21 12 1
VI	...	949	1,598	576	1,125	621	691	231	339	302	837	311	489	13 1 1	11 0 8	11 12 4	8 6 7
VII	...	799	1,297	418	796	209	316	167	462	279	521	107	212	4 10 6	11 0 8	...	...
VIII	...	705	1,137	584	1,115	236	311	65	255	294	556	252	447	10 12 4	10 5 0	9 13 6	6 1 10

I need not say that the B series is the duplicate of A series. The difference between the two series is, that the former is unirrigated, while the latter is irrigated. The results are similar to those of last year. It was noticed in previous years that when there are no cold-weather showers, plots manured with cow-dung and unirrigated become infested with white-ants. This opinion which I formed was corroborated this year also. The plot (No. V) manured with cow-dung and bone-dust has shown good results, and stands first in this series. But the plot (No. II) manured with bone-dust alone gives a much smaller outturn, thereby indicating that the bone-dust though it does not by itself improve the yield, yet seems in conjunction with cow-dung to prevent the attacks of white-ants, and to allow the plot to derive the full benefit from the cow-dung.

FIELD No. 18. SUBJECT.—*Relative effect of green-manuring, box-dung and stall-dung on wheat grown continuously.*

Plot I.—Area 0.25 acre. Green-manured with kadoojira (*Vernonia cineria*) in year under report.

" II. " 0.25 " Unmanured.

" III. " 0.25 " Manured with box-dung at 240 maunds per acre.

" IV. " 0.25 " " stall-dung, at 160 maunds per acre.

Commenced in 1890-91. Unirrigated. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.											Cost of cultivation per acre.	Cost of manuring per acre.	Gain in value on plot No. II.	
	AVERAGE OF PRECEDING FIVE YEARS, 1890-91 to 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.						
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.				
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.				
I	594	878	276	433	32	75	83	196	291	429	12 1 11	13 2 0	7 15 8	3 4 2
II	473	727	462	640	63	121	225	519	213	311	8 13 9	13 0 8	...	...
III	657	1,179	755	1,036	185	375	348	760	613	890	25 7 8	13 15 8	12 1 8	16 9 11
IV	624	878	798	1,161	202	441	489	918	740	1,040	30 10 1	12 14 8	12 9 4	21 12 4

All the plots gave better outturns than last year. Plot (No. IV), manured with stall-dung, has been standing high since 1895. The plot (No. I) which was green-manured and which always occupied the last place, has shown very good results this year. As the weed *Psorolia* was not available within reasonable distance the plot was green-manured with *kadoojira*, a weed belonging to the order *compositæ* and growing in large quantities on the Farm. The good outturn of plot No. I may be due to a larger quantity of the weed being used.

FIELD No. 32. SUBJECT.—*Effect on wheat of green-manuring with cut Compositæ weed, kadoojira (Vernonia cineria) collected from waste land on the Farm.*

Plot I.—Area 0.16 acre. Green-manured with *kadoojira* in year under report.

" II. " 0.16 " Unmanured.

Commenced in 1891-92. Unirrigated. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.									Cost of cultivation per acre.	Cost of manuring per acre.	Gain in value on plot No. II.	
	AVERAGE OF PRECEDING FIVE YEARS, 1891-92 to 1895-96.		1896-97.		1897-98.		1898-99.						
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Value.				
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	759	1,345	329	452	562	1,187	509	648	20 13 2	11 4 9	7 8 10	3 7 5	
II	551	1,000	333	535	498	1,027	412	662	17 5 9	11 1 1	...	...

This year also the green-manured plot (No. I) gave a better outturn and a larger profit than plot No. II which was unmanured. The results of the experiments in these plots bear out the conclusions of the last eight years, *viz.*, that green-manuring is beneficial to a wheat

crop in low-lying fields containing moisture sufficient for the thorough decomposition of the matter which is buried in the ground. As *Psorolia* was not to be had in sufficient quantity, plot No. I was manured with the *Compositae* weed *kadoojira*.

FIELDS Nos. 23 AND 68. SUBJECT.—*Effect on wheat of manuring with saltpetre at different rates per acre with and without irrigation.*

FIELD No. 23 (*Unirrigated*).

Plot I.—Area 0.30 acre. Unmanured.
 " II. " 0.30 " Manured with 240lbs. of saltpetre per acre (80lbs drilled with the seed, and 160lbs. top-dressed).
 " III. " 0.30 " Manured with 80lbs of saltpetre per acre as top-dressing.

FIELD No. 68 (*Irrigated*).

Plot I.—Area 0.10 acre. Unmanured.
 " II. " 0.10 " Manured with 240lbs. of saltpetre per acre (80lbs. drilled with the seed, and 160lbs. top-dressed).
 " III. " 0.10 " Manured with 80lbs. of saltpetre per acre as top-dressing.

Crop, wheat (haura)—Nagpur.

OUTTURN PER ACRE OF FIELD No. 23							OUTTURN PER ACRE OF FIELD No. 68.						
No. of plot.	1897-98.		1898-99.				No. of plot.	1897-98.		1898-99.			
	Grain.	Straw.	Grain.	Straw.	Value.	Gain on plot No. I.		Grain.	Straw.	Grain.	Straw.	Value.	Gain on plot No. I.
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.		lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I ...	345	678	244	426	10 6 5	...	I...	620	910	377	422	15 3 0	...
II ...	372	672	282	465	11 14 9	1 8 4	II ...	999	1,231	1,059	1,091	42 6 2	27 3 2
III ...	413	767	290	527	12 7 0	2 0 7	III...	1,075	1,305	1,202	1,247	48 2 3	32 15 3

NOTE.—Field No. 68 was irrigated twice: once on 1st December 1898, and again on 9th January 1899.
 Field No. 23 was not irrigated.

The results of both the fields are quite in accord with the assumption made in last year's report, *viz.*, that an abundance of saltpetre produces a deleterious effect on the wheat crop. Plot No. III in each of the fields which were manured with 80lbs. of saltpetre as a top-dressing, has shown the best results. Irrigation alone has this year increased the outturn nearly five-fold in Field No. 68.

FIELDS Nos. 15 AND 55. SUBJECT.—*The effect of manuring wheat at different times of the year, i.e., June and August.*

FIELD No. 15.

Plot I.—Area 0.23 acre. Manured with 160 maunds duog in June.
 " II. " 0.23 " Manured with 160 maunds duog in August.

FIELD No. 55.

Plot I.—Area 0.27 acre. Manured with 160 maunds duog in June.
 " II. " 0.27 " Manured with 160 maunds duog in August.

Crops, wheat (baura)—Nagpur.

OUTTURN PER ACRE OF FIELD No. 15.						OUTTURN PER ACRE OF FIELD No. 55.					
No. of plot.	1897-98.		1898-99.			1897-98.		1898-99.			
	Grain.	Straw.	Grain.	Straw.	Value.	Grain.	Straw.	Grain.	Straw.	Value.	
	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	
I ...	220	498	222	483	9 13 1	258	519	276	520	11 14 7	
II ...	166	312	206	398	8 14 10	181	389	209	402	9 0 10	

The object of the experiment is to test whether manures, such as cow-dung, give better results when applied at a later period of the year than at the usual time which is in June. As stated in last year's report the time for manuring plots No. II in both the fields was carried further back, *i.e.*, the plots were manured on the 3rd of August. The quantity of rainfall received by these plots from the date of manuring to the date of sowing was 21.25 inches, which was insufficient for the purpose of assimilating the manure. For this reason a correct conclusion cannot be drawn, but the results will be watched for some years more.

VILLE SERIES. SUBJECT.—*Practical method of soil analysis by using chemical manures, as devised by Mr. George Ville.*

Plot I.—Area .05 acre. Manured with Ammonic chloride, 140lbs. per acre.

„ Calcic superphosphate, 180lbs. per acre.

„ Potassic sulphate, 90lbs. per acre.

„ Calcic sulphate, 100lbs. per acre.

„ II. „ .05 „ „ as above less calcic superphosphate.

„ III. „ .05 „ „ as in plot No. I less ammonic chloride.

„ IV. „ .05 „ No manure.

„ V. „ .05 „ Manured as in plot No. I less potassic sulphate.

„ VI. „ .05 „ „ „ „ „ calcic sulphate.

Commenced in 1895-96. Unirrigated. Crop, linseed (chaval-katha).

No. of plot.	OUTTURN PER ACRE.									
	1895-96.		1896-97.		1897-98.		1898-99.			
	Seed.	Stalks.	Seed.	Stalks.	Seed.	Stalks.	Seed.	Stalks.	Value.	Gain in value on plot No. IV.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I	160	360	2	37	30	50	2	12	0 2 2	-0 1 8
II	180	390	4	36	45	95	43	2	0 0 5	-0 3 5
III	197	372	7	72	45	115	2	17	0 2 5	-0 1 5
IV	155	355	12	67	60	140	2	47	0 3 10	...
V	172	336	5	55	50	90	5	40	0 5 10	+0 2 0
VI	160	303	2	37	42	97	6	34	0 6 3	+0 2 5

This is the fourth year of the experiment and the results are quite inconsistent. According to the advice given by Dr. Leather in his note of the 2nd December 1898, attached to this report, the experiment has been dropped. The site of the plots will also be changed and wheat instead of linseed will be grown next year with the same chemical manures.

SERIES C. SUBJECT.—*Effect on linseed grown continuously of different kinds of manures applied year after year.*

Plot I.—Area .10 acre. Manured with saltpetre, 240lbs. per acre.

„ II. „ .10 „ „ bone-dust, 360lbs. per acre.

„ III. „ .10 „ „ kadoojira (*Vernonia cineria*) to be ploughed in green.

„ IV. „ .10 „ „ dung, 160 maunds per acre.

„ V. „ .10 „ „ kadoojira (*Vernonia cineria*) to be ploughed in green.

„ VI. „ .10 „ „ ashes of 160 maunds dung.

„ VII. „ .10 „ „ unmanured.

„ VIII. „ .10 „ „ green-manured with san-hemp.

Commenced in 1895-96. Crop, linseed (chaval-katha)—unirrigated.

No. of plot.	OUTTURN PER ACRE.											
	1895-96.		1896-97.		1897-98.		1898-99.			Cost of cultivation per acre	Cost of manuring per acre.	Gain in value on plot No. VII.
	Seed.	Stalks.	Seed.	Stalks.	Seed.	Stalks.	Seed.	Stalks.	Value.			
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs a. p	Rs. a. p.	Rs. a. p.	Rs. a. p.
I ...	411	589	130	305	126	244	79	221	4 7 10	10 5 0	13 2 0.	0 4 9
II ...	521	739	164	496	210	410	104	296	5 14 10	10 5 0	3 6 0	1 11 9
III ...	571	819	111	379	192	357	65	285	4 0 4	9 8 6	15 0 10	0 2 9
IV ...	500	780	191	439	296	530	194	506	10 14 7	10 8 4	12 9 8	6 11 6
V ...	492	734	127	352	260	470	194	456	10 12 1	9 15 2	15 0 10	6 9 0
VI ...	531	875	147	412	204	416	114	306	6 7 0	9 15 2	11 12 4	2 3 11
VII ...	445	682	157	502	187	302	71	249	4 3 1	9 15 2	...	...
VIII ...	365	575	44	266	269	481	159	361	8 12 5	9 3 6	9 13 6	4 9 4

I now come to the C series.

This series was started in 1895-96 in accordance with Dr. Leather's suggestion by adopting natural instead of chemical manures for linseed crops.

The outturns in all the plots are gradually decreasing year by year which is in accord with our experience that linseed cannot be grown year after year in the same field. This experiment will be discontinued next year and the field will be utilized for some other experiments.

FIELD No. 9. SUBJECT.—*Effect of phosphatic manures on different oil-seeds suggested by Dr. Leather.*

Plot I.—Area '27 acre. Unmanured.

" II. " '27 " Manured with saltpetre, 281'9lbs. per acre.

" III. " '27 " " with burnt bones, 277lbs. per acre.

" IV. " '27 " " with raw bones, 393lbs. per acre.

" V. " '27 " " with raw bones, 393lbs. and saltpetre, 281'9 lbs. per acre.

Commenced in 1896-97.

No. of plot.	Area.	OUTTURN PER ACRE.									Remarks.			
		1896-97.			1897-98.			1898-99.						
		Crop.	Seed.	Stalks.	Crop.	Seed.	Stalks.	Crop.	Seed.	Stalks.				
	Acres.		lbs.	lbs.		lbs.	lbs.		lbs.	lbs.				
I E	'14	Til	...	243	714	Mustard	...	...	Kardi (saf- flower).	592	1,170	Mustard failed in 1897-98 in plots I E, III E, IV E and V E.	
II E	'14	"	...	362	936	"	...	30	316	"	724		1,508	
III E	'14	"	...	221	671	"	...	...	"	...	687		1,380
IV E	'14	"	...	218	764	"	...	...	"	...	437		940
V E	'14	"	...	154	664	"	...	...	"	...	313		710
I W	'13	Kardi (saf- flower).	384	778	Linseed	...	304	427	Til	...	16	77		
II W	'13	"	...	359	1,149	"	...	295	512	"	...	197	508	
III W	'13	"	...	441	697	"	...	236	395	"	...	61	208	
IV W	'13	"	...	458	750	"	...	196	373	"	...	70	238	
V W	'13	"	...	321	556	"	...	79	152	"	...	25	123	

FIELD No. 59. SUBJECT.—*Effect of phosphatic manures on different oil-seeds suggested by Dr. Leather.*

Plot I.—Area '31 acre. Unmanured.

" II. " '31 " Manured with saltpetre, 281'9lbs. per acre.

" III. " '31 " " burnt bones, 277lbs per acre.

" IV. " '31 " " raw bones, 393lbs. per acre.

" V. " '31 " " 393lbs. and saltpetre, 281'9lbs. per acre.

Commenced in 1896-97.

No. of plot.	Area.	OUTTURN PER ACRE.									Remarks.
		1896-97.			1897-98.			1898-99.			
		Crop.	Seed.	Stalks.	Crop.	Seed.	Stalks.	Crop.	Seed	Stalks.	
	Acre.		lbs.	lbs.		lbs.	lbs.		lbs.	lbs.	
I E	'15	Linseed ...	5	48	Til ...	230	920	Linseed ...	103	276	
II E	'15	" ...	1	12	" ...	382	1,413	" ...	67	172	
III E	'15	" ...	5	49	" ...	447	1,560	" ...	121	299	
IV E	'15	" ...	6	47	" ...	353	1,293	" ...	132	367	
V E	'15	" ...	5	48	" ...	337	1,040	" ...	117	336	
I W	'16	Mustard ...	.74	148	Kardi (safflower).	922	1,897	Mustard ...	162	361	
II W	'16	" ...	61	111	" ...	857	2,137	" ...	175	356	
III W	'16	" ...	78	131	" ...	947	2,253	" ...	113	257	
IV W	'16	" ...	144	281	" ...	930	2,276	" ...	62	218	
V W	'16	" ...	65	116	" ...	851	1,924	" ...	137	342	

The outturns of Field No. 9, which was cropped by til and kardi (safflower) in the year 1896-97, are to be compared with the outturns of the year under report in order to investigate the effects of phosphatic manure on oil-seeds grown alternately.

The til crop was a complete failure owing to there being heavy showers of rain which fell shortly after the seed was put down. The safflower crop was fair. Plot No. II E, manured with saltpetre alone, stands first; but plot No. V E, manured with saltpetre and bone-dust, stands the last. The same plot stood last in the year 1896-97. Plot No. III E, manured with burnt bones, stands second. The unmanured plot stands 3rd, this plot occupied the same position in the year before last. Plot No. IV E, manured with raw bones, stands 4th; but this plot showed the best results in the first year of the experiment. The results are discouraging and may be due to the unevenness of the field.

In Field No. 59 plots which were impoverished by the successive cropping of linseed in previous years, have shown much improvement. It may be due to the rotation of linseed with til. The outturn of linseed of each of the plots in previous years never exceeded 6lbs. per acre, while the quantity of seed sown per acre was 12lbs. Plot No. III E. and IV E, manured with burnt bones and raw bones, have shown pretty fair results. The plot manured with saltpetre stands last. As to mustard the germination was most uneven, the moisture in the fields being insufficient for its germination. The outturns are pretty fair, but they cannot be compared with the outturns of 1896-97, which was a bad year for the mustard crop.

12. The experiments referred in this paragraph have two objects: first, to ascertain what period of years the effect of manures applied to fields on the lines of the system initiated by Lieutenant Meagher of Allahabad, lasts; secondly, how far this system of manuring improves the outturn of different crops.

Manuring fields on the Meagher system.

In the year under report Fields Nos. 54, 56 and 58, area 2'61 acres, were manured on the above system, and were sown with juar and rice. These fields in previous years never gave an outturn of even 30 per cent. of any normal crop. The fields were manured in the months of April and May, and were sown with juar on 11th July and reaped on the 23rd November. The yield per acre is 2,912 lbs. Such an outturn is quite exceptional and is seldom or never reaped even on the richest soils. The rice crop gave an outturn of 1,815lbs. per acre. The

shortness of the outturn is due to the seedlings having been washed away by the floods on the 22nd July, as the crop was sown in low-lying pockets of the fields. Field No. 50 was manured on the above system in the year 1896-97, no manure being subsequently used.

The field was sown with Bani cotton. The yield per acre was 473lbs. of seed cotton, which is double the average.

Field No. 52, which was manured on the same system last year and cropped with juar, was this year sown with Nimari cotton. The crop was a bumper one, and the yield per acre was 435lbs. of seed cotton.

IV.—ROTATION EXPERIMENTS WITHOUT MANURES.

13. These experiments are conducted in three different fields. Their object is to test the practices observed by the cultivators of these provinces and to see whether there is any practical possibility of improving on them. In Field No. 29 wheat is followed by gram, juar, &c., or a fallow. In Field No. 57 linseed is followed by cotton and other crops. In Field No. 61 cotton-tur is followed by wheat and gram. The most important of these experiments are those conducted in Fields Nos. 29 and 57. Experiments in these fields were started eight years ago; while the experiment in Field No. 61 began in 1893-94. The results which have been obtained in the case of each of these plots are tabulated below and are compared with those of previous years.

FIELD No. 29. SUBJECT.—*Effect of rotation with wheat.*

Plot I.—Area '13 acre. Wheat every year.

" II. " '13 " " and fallow alternately.

" III. " '13 " " " gram alternately.

" IV. " '13 " " " juar and tur (mixed) alternately.

" V. " '13 " " " kodon alternately.

Commenced in 1890-91. Unmanured and unirrigated. For Cropping, see Column 2 below.

No of plot	Crop.	OUTTURN PER ACRE.										Cost of cultivation per acre.	Total outlay in cultivation per acre since commencement of experiment (9 years).	Total value of produce per acre since commencement of experiment (9 years).	Total profit per acre since commencement of experiment (9 years).	
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.														
		1895-96		1896-97.		1897-98.		1898-99.								
		Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.					Value.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.	Rs. s. p.
I	Wheat...	578	960	855	1,031	331	513	400	854	493	676	20 5 6	12 20 7	86 21 3	204 11 7	118 0 4
II	Wheat .. and Fallow..	638	1,338	...	...	382	616	...	...	443	649	28 6 11	13 2 0	59 6 3	117 1 4	57 21 1
				
III	Wheat .. and Gram ...	568	1,225	...	...	441	774	...	...	540	937	23 0 1	18 4 2	81 15 0	183 5 11	102 6 11
	...	444	840	508	840	...	...	500	846	...	...	...	
IV	Wheat .. and Juar ... and Tur ...	654	1,320	...	...	283	533	...	...	428	764	28 5 0	12 15 1	90 2 11	285 15 4	195 13 5
	...	164	1,228	579	1,663	...	...	776	6,530	...	...	...	
	...	259	741	566	853	...	...	445	778	...	...	...	
V	Wheat .. and Kodon ..	726	1,402	...	...	205	426	...	...	386	730	16 10 8	11 15 8	78 2 5	156 7 1	78 4 8
	...	399	638	549	628	...	...	853	1,215	...	...	...	

During the year under report wheat was sown in all the plots on 20th October and reaped on 15th February. The outturn of the plot is below the average of the preceding years owing to the deficiency of rain. Plot No. III, sown with wheat after gram, stands first—a result quite natural as cereals use nitrogen previously stored by a leguminous crop. Plot No. II, sown with wheat after fallow although standing third still in point of profit, is below the other plots, and it proves that the loss caused to a cultivator by keeping a plot fallow every other year, is not recouped by the larger yield obtained in the alternate years. Plot No. IV, although as regards wheat it stands fourth, gives larger profits from the rotation of juar and tur than those obtained from plots on which crops were grown in rotation of fallow and kodon. Plot No. I, sown with wheat every year, has given fairly good results.

FIELD No. 57. SUBJECT.—*Rotations with linseed.*

Plot I.—Area 28 acre. Linseed every year.

" II. " 28 " " and gram alternately.

" III. " 28 " " cotton alternately.

" IV. " 28 " " tur alternately.

Unmanured and unirrigated. For Cropping, see Column 2 below.

No of plot.	Crop.	OUTTURN PER ACRE.												Cost of cultivation per acre.	Total outlay in cultivation since commencement of experiment (9 years).	Total value of produce per acre since commencement of experiment (9 years).
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.						
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.				
		lbs.	lbs.	lbs.	lbs.	lbs. oz.	lbs. oz.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
I	Linseed ...	40	118	19	57	0 7	3 13	13	51	16	112	1 1 11	7 2 3	52 12 9	13 9 1	
II	Linseed ...	41	98	...	...	0 3	2 0	...	...	31	98	1 12 9	* 8 13 4	63 12 9	46 14 4
	Gram ...	278	416	273	413	...	...	271	371	...	...	...	
III	Linseed ...	35	115	...	...	0 3	1 5	...	...	83	207	4 10 3	8 4 5	65 8 1	66 7 10
	Cotton ...	33	87	100	203	...	...	84	191	...	...	...	
IV	Linseed ...	46	143	...	...	0 3	2 0	...	...	103	212	5 9 10	* 10 9 3	67 9 8	103 10 1
	Tur ...	617	1,650	783	1,918	...	...	801	2,049	...	...	...	

NOTE.—Plots Nos. II and IV were green-manured with coriander in year under report.

* Including cost of green-manuring with coriander.

As stated in last year's report plot Nos. II and IV were green-manured with coriander on the 27th of August. The crop was sown on the 29th of June and did not thrive well, as coriander is generally sown as a cold-weather crop.

Linseed was sown in all the plots on October 4th. Plot No. II has not shown any appreciable difference in yield, but plot No. IV has. The outturn was 103lbs. which is exceedingly good, if compared with the yield, of 1896-97, which was only 30z.

FIELD No. 61. SUBJECT.—*Rotations with cotton and tur.*

Plot I.—Area 30 acre. Cotton tur year after year.

" II. " 30 " " tur in rotation with wheat.

" III. " 30 " " tur in rotation with gram.

Commenced in 1893-94. Unmanured and unirrigated. For Cropping, see Column 2 below.

No. of plot.	Crop.	OUTTURN PER ACRE.					Cost of cultivation per acre.	Total outlay in cultivation since commencement of experiment (6 years).	Total value of produce since commencement of experiment (6 years).
		AVERAGE OF PRECEDING FIVE YEARS, 1893-94—1897-98.		1898-99.					
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.			
		lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I	Cotton ...	36	78	82	188	16 4 1	22 9 11	68 13 10	111 5 1
	Tur	372	908	116	431				
II	Cotton ...	58	121	...	...	16 14 10	75 13 3	142 1 7	
	Tur and Wheat ...	621	1,595	...	...		
III	Cotton ...	388	653	426	740	11 14 6	62 7 1	115 0 7	
	Tur and ...	55	113	...	...		
	Gram ...	511	1,322	...	...		
		371	546	251	332	7 3 9			

The object of the experiment conducted in this field is to ascertain whether it is more profitable to grow cotton-tur year after year in the same field, or, if a rotation is desirable, whether wheat or gram would be the most suitable crop to raise in every alternate year. Plot No. I was sown with cotton-tur according to the conduct of the experiment. The tur crop was far below the average owing to the tur stalks having withered away from causes unknown before they came to maturity. The withering away of these plants is becoming a matter of yearly recurrence, and the yield of the fields grown with tur is much reduced year by year. Are the fields becoming tur-sick as in the case of linseed?

The outturn of cotton exceeded in plot No. I the average by 12 per cent.

In plots Nos. II and III the outturns of wheat and gram were fair considering the dry character of the season of the year. A reference to the last column of the above table will show that plot No. II stands first in point of value of the produce of the last 6 years.

The outturn of tur has also not much diminished. I think that this result is due to the fact that the nitrogen stored by the leguminous crop is consumed by the wheat crop which follows, the field being allowed to accumulate fresh quantities of nitrogen by the tur crop which succeeds.

The case of plot No. III is quite different. Tur and gram belong to the same family, having the same properties of storing nitrogen. The yield therefore of both tur and gram is reduced, the field being enriched with a substance which the crops are not in need of.

V.—ROTATION EXPERIMENTS WITH MANURES.

14. There are five fields in which experiments in manure and rotations are tried.

In Fields Nos. 14 and 17 the experiment is designed to bring out the advantage of green-manuring on a rotation of wheat and cotton.

In the other fields the effect of the various manures, stall-dung, box-dung, bone-dust and lime, was tested on the following crops grown in rotation :—

Cotton and wheat, wheat and tur. The field lettered 42N was devoted to an experiment to test the effect of phosphatic and potassic manures on tur (nitrogen-fixing crops) in rotation with wheat. The results which have been obtained this year in the case of each of these experiments are contrasted below with those of previous years.

FIELD NO. 14. SUBJECT.—*Effect of green-manuring with san-hemp (Crotalaria juncea) on wheat with fallow interposed, and on wheat in rotation with cotton.*

Plot I.—Area	18 acre.	Green-manuring followed by fallow and then by wheat.
" II. "	" 18 "	Wheat alternating with fallow, but unmanured.
" III. "	" 18 "	Green-manuring followed by wheat and then by cotton.
" IV. "	" 21 "	Wheat and cotton in rotation, but unmanured.
Commenced in 1891-92.		No green-manuring in year under report. For Cropping, see Column 2 below.

No. of plot	Crop.	OUTTURN PER ACRE.										TOTAL FROM COMMENCEMENT OF EXPERIMENT (8 YEARS)		
		AVERAGE OF PRECEDING FIVE YEARS, 1891-92 to 1895-96.		1896-97.		1897-98.		1898-99.			Cost of cultivation including green-manuring.	Value of produce.		
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.				
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
I	Wheat ...	697	1,194	41	103	...	...	233	423	9 15 11	95 5 9	65 14 10
II	Wheat ...	592	724	53	124	...	...	108	225	4 11 10	67 3 3	51 6 1
III	Wheat and Cotton ...	445	851	...	...	183	406	...	...	...	130 14 5	119 13 4
	Wheat and Cotton ...	57	146	35	86	...	...	93	213	15 0 4		
IV	Wheat and Cotton ...	486	926	...	...	330	699	...	...	...	94 8 5	134 1 10
	Wheat and Cotton ...	50	132	71	159	...	...	91	210	14 11 5		

It has been observed that the plots allotted to these experiments are all dissimilar. There is a big sub-soil strip of gneiss rock running in a zigzag way in all the 4 plots which does not allow the crops to grow evenly, thereby vitiating the results. The experiment has been therefore transferred to Field No. 63.

FIELD No. 17. SUBJECT.—*Effect on wheat and cotton in rotation of green-manuring with kadoojira.*

Plot I.—Area 15 acre. Green-manured with cut weeds every alternate year.

" II. " 15 " No manure.

Commenced in 1890-91. Unirrigated. Crop, wheat (haura)—Nagpur, in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.											Cost of cultivation per acre.	Cost of green- manuring per acre.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.				
		Grain or lint.	Straw or seed.	Lint.	Seed	Grain.	Straw.	Lint.	Seed.	Grain.	Straw.	Value.		
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I...	Wheat ...	569	1,246	...	...	233	447	...	...	454	826	19 7 9	12 1 4	10 15 7
	Cotton ...	58	141	134	262	...	...	130	281	...	...	...
II...	Wheat ...	347	816	...	...	120	192	...	...	332	605	14 4 0	12 2 9	...
	Cotton ...	43	112	109	208	...	...	106	244	...	...	...

Wheat was sown in both these plots on the 20th October and reaped on the 17th February. The outturn of wheat in plot No. I, which was green-manured, exceeded by 37 per cent. that of plot No. II, which was unmanured. The results obtained on green-manured plot of this field show that wheat and cotton crops derive great benefits by being green-manured.

FIELD No. 44. SUBJECT.—*Relative effect on cotton and wheat in rotation of box-dung, stall-dung and bone-dust.*

Plot I.—Area 27 acre. Manured with stall-dung at 160 maunds per acre.

" II. " 27 " " box dung at 240 " "

" III. " 27 " Unmanured.

" IV. " 27 " Manured with bone-dust at 360lbs. per acre.

Commenced in 1890-91. Unirrigated. Crop, cotton (jari) in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.											Cost of cultivation per acre.	Cost of manuring per acre.	Gain in value on plot No. III.
		AVERAGE OF PRECEDING FIVE YEARS 1890-91 TO 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.					
		Grain or lint.	Straw or seed.	Grain.	Straw.	Lint.	Seed.	Grain.	Straw.	Lint.	Seed.	Value.			
I	Cotton ...	44	106	117	283	172	395	27 12 8	15 9 1	12 1 3	19 13 11
	Wheat ...	515	897	740	1,030	...	...	555	850	...	...	...
II	Cotton ...	59	137	218	493	215	493	34 11 9	16 7 7	11 8 11	26 13 0
	Wheat ...	643	958	868	1,321	...	...	656	1,618	...	...	...
III	Cotton ...	25	53	41	99	49	113	7 14 9	9 11 7
	Wheat ...	349	464	279	458	...	...	218	579	...	...	...
IV	Cotton ...	24	50	32	70	53	123	8 9 3	9 12 9	3 6 0	0 10 6
	Wheat ...	281	386	242	448	...	...	174	534	...	...	...

Cotton was sown in all the plots in the year under report. The plants in plots Nos. I and II, which were manured with stall and box-dung respectively, were exceptionally luxuriant in their growth. The yield is also just as good as it was in the year before last. Bone-dust manure does not, it seems, improve the yield of cotton.

FIELD No. 65. SUBJECT.—*Effect of liming soils on wheat in rotation with cotton.*

Plot I.—Area '43 acre. Manured with lime in 1890-91 (not to be limed again until 1902-03).

" II. " '43 " Not manured with lime.

Commenced in 1890-91. Unirrigated crop, wheat (haura)—Nagpur, in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.										Cost of cultivation per acre.	Value of produce per acre.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.			
		Grain or lint.	Straw or seed.	Lint.	Seed.	Grain	Straw.	Lint.	Seed.	Grain.	Straw.		
		lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I ...	Wheat ...	557	982	...	...	21	86	...	...	157	297	13 5 2	6 12 6
	Cotton ...	34	92	91	199	...	...	116	266	...	...
II ...	Wheat ...	543	1,230	...	...	50	115	...	...	144	298	13 1 11	6 4 11
	Cotton ...	32	82	75	169	...	...	112	256	...	...

This experiment though conducted for the last nine years has shown very capricious results. Besides, the soil of the farm possesses a sufficient amount of calcium carbonate and needs no further application. The experiment has been dropped—*vide* Dr. Leather's note annexed.

FIELD No. 42N. SUBJECT.—*Effect on tur and wheat grown in rotation of potassic and phosphatic manures.*

Plot I.—Area '10 acre. Manured with powdered bones, 36cibs. per acre, and potassic sulphate, 90lbs. per acre.

" II. " '10 " Unmanured.

Commenced in 1896-97. Crop, tur in year under report.

No. of plot.	Crop.	OUTTURN PER ACRE.						Value.	Gain in value on plot No. II.
		1896-97.		1897-98.		1898-99.			
		Grain.	Stalks.	Grain.	Straw.	Grain.	Stalks.		
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I	Tur	756	1,422	...	...	564	1,020	12 4 11	0 13 3
	Wheat	...	...	414	899	...	...	...	...
II	Tur	656	1,372	...	...	525	945	11 7 8	...
	Wheat	...	...	397	810	...	...	...	...

In the year under report, tur in Field No. 42N., was sown after the plot was manured with powdered bones and potassic sulphate, which contains no nitrogen. The outturn of the tur crop shows a slight improvement when compared with plot No. II, which was not manured. It will be seen next year when wheat will be sown in both the plots how far tur has enriched with nitrogen the soil of plot No. I.

VI.—EXPERIMENTS WITH MIXTURES OF CROPS.

15. *Mixtures of Crops.*—These experiments were started with the object of testing the expediency of the practice of cultivators of the province in growing crop mixtures. Two fields were allotted for conducting these experiments. The experiment in Field No. 25 of mixing gram and wheat known in the Nerbudda Valley as *birra*, was commenced in 1890-91; while the experiment of mixing (1) juar and cotton, and (2) cotton and tur in Field No. 55, was begun in 1893-94. Results are given in the table below.

FIELD No. 25. SUBJECT.—*Effect of mixing crops, wheat and a leguminous crop (gram).*

Plot I.—Area '21 acre. Wheat sown alone.

" II. " '21 " Wheat mixed with gram.

Commenced in 1890-91. Unmanured and unirrigated crop, wheat (haura, Nagpur) and gram.

No. of plot.	Crop.	OUTTURN PER ACRE.										Cost of cultivation per acre.	Value of produce per acre.
		AVERAGE OF PRECEDING FIVE YEARS, 1890-91 to 1894-95.		1895-96.		1896-97.		1897-98.		1898-99.			
		Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.		
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.
I ...	Wheat ...	420	616	383	478	150	288	345	646	176	352	11 7 4	7 10 8
II ...	Wheat ...	290	458	266	422	93	240	275	496	110	195	11 11 8	6 4 4
	Gram ...	161	275	53	95	62	147	105	152	48	123		

Both these plots being high-lying, lost much of their moisture very soon owing to the absence of cold-weather showers. The outturn of both the plots are less even than that of the last year, which was not a good year for wheat. As stated in the report for the preceding year, I think that in a dry season the vicinity of a gram plant deprives the wheat, which is a surface-feeding plant of moisture which, but for the presence of the gram the wheat might manage to exist upon.

FIELD No. 55. SUBJECT.—*Effect of mixing crops, principal one being cotton with tur and juar.*

Plot III.—Area. '27 acre. Cotton (jari) alone.

" IV. " '27 " " (jari) and tur in the proportion of 6 lines to 2.

" V. " '27 " " (jari) and juar in the proportion of 6 lines to 2.

Commenced in 1895-96. Unmanured.

No. of plot.	Crop.	OUTTURN PER ACRE.									Cost of cultivation per acre.	Gain in value on plot No. III.
		1895-96.		1896-97.		1897-98.		1898-99.				
		Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Grain or lint.	Straw or seed.	Value.		
III ...	Cotton ...	107	202	50	125	91	209	86	198	Rs. a. p. 13 14 5	Rs. a. p. 11 0 10	Rs. a. p. ...
IV ...	Cotton ...	63	125	23	47	55	127	87	200	21 1 6	11 8 7	7 3 1
	Tur ...	487	966	461	717	716	1,273	297	687			
V ...	Cotton ...	49	94	24	57	41	107	63	145	23 15 7	11 14 9	10 1 2
	Juar ...	218	1,346	191	1,050	378	2,174	330	1,026			

* Excluding cost of watching.

In all the three plots referred to above the outturn of cotton was fair. In point of gain on plot No. III, which is grown with cotton alone, the plot on which cotton is mixed with juar stands first. Plot No. IV sown with cotton and tur stands second. The results are quite in accord with the experience of the past four years.

VII.—EXPERIMENTS WITH TILLAGE.

16. Only one of our experiments falls under this head. It was started in 1890-91 in order to test the practice of the cultivators who merely scarify the ground for sowing wheat. The field is divided into three plots. The first plot is ploughed every year; the second is scarified (bakhared) every year, and the third is ploughed and hoed in alternate years. The results are embodied in the subjoined table.

In accordance with instructions conveyed in para. 3 of Secretariat letter No. 869, dated 13th February 1897, the experiment is duplicated in Field No. 22.

FIELD NO. 21. SUBJECT.—*Effect of tillage to various depths.*

Plot I.—Area '23 acre. Ploughed every year.

" II. " '23 " Bakhared (scarified) every year.

" III. " '23 " Ploughed and bakhared in alternate years.

Commenced in 1890-91. Unirrigated and unmanured. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.											Cost of cultivation per acre.	Gain in value on plot No. II.
	AVERAGE OF PRECEDING FIVE YEARS, 1890-91 TO 1894-95		1895-96.		1896-97.		1897-98.		1898-99.				
	Grain.	Straw	Grain.	Straw	Grain.	Straw	Grain.	Straw.	Grain.	Straw.	Value		
	lbs.	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a p.	Rs. a. p.
I ...	398	761	340	472	76	161	273	549	92	321	4 8 2	12 13 1	-2 5 4
II ..	503	1,031	306	459	98	193	192	560	161	274	6 13 6	10 13 11	...
III ..	582	1,073	480	712	154	272	289	768	206	468	9 2 11	10 9 11	+2 5 5

FIELD NO. 22. SUBJECT.—*Effect of tillage to various depths.*

Plot I.—Area '28 acre. Ploughed every year.

" II. " '28 " Bakhared (scarified) every year.

" III. " '28 " Ploughed and bakhared in alternate years.

Commenced in 1897-98. Unirrigated and unmanured. Crop, wheat (haura)—Nagpur.

No. of plot.	OUTTURN PER ACRE.					Cost of cultivation per acre.	Gain in value on plot No. II.
	1897-98.		1898-99.				
	Grain.	Straw.	Grain.	Straw.	Value.		
	lbs	lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.
I ...	368	850	579	748	23 11 8	14 9 0	+5 3 8
II ...	344	817	439	707	18 8 0	11 3 9	...
III ...	310	708	294	556	12 11 0	12 3 2	-5 13 0

The experience of the past nine years has proved that the plot ploughed and bakhared in alternate years, gives the best result. But the new Field No. 22 shows uneven results. The outturns are fair for the season; but the plots, though lying in a level ground, differ in their fertility. This is only the second year of the experiment, and I am unable to draw any deductions.

VIII.—VARIETY OF CROPS.

17. With letter No. 2574-10, dated 18th June 1898, from the Commissioner of Settlements and Agriculture, Central Provinces, five different varieties of Bajari (*Pennisetum typhoidum*) and two varieties of Sorghum grown at the Poona Farm were forwarded to me for trial. The seed was sown on 21st June in Field No. 60, which was last year manured after the Meagher system, and from which bumper crops of cotton was picked. The plants began to grow very luxuriantly, and as they tillered freely, the crop became very thick. The stalks were 12 feet high and came to maturity by the middle of September. Out of the 5 varieties of Bajari, Awned, Nadiad, Bajro and Malbandro tillered more freely than the Bhownagri and Poona select. The crops having come to maturity earlier, were slightly damaged by rain. The yield per acre was :—

Name of variety.	Outturn per acre.						
	lbs.						
Nadiad	1,526
Malbandro	1,551
Bhownagri	1,489
Awned	1,503
Poona select	1,641

Of the two varieties of Sorghum, amber and collier are both early varieties. The stalks are thin, and when green the cattle eat them with great avidity. It is a very valuable fodder plant, as it grows very fast and comes to maturity very soon. The practice of the cultivators in these provinces is to grow sometimes juar with an eye to fodder. They call it Kadyaloo. If these varieties of Sorghum were cultivated in these provinces it will enable cultivators to sow any *rabi* crops in the same ground after the Sorghum crop is reaped. The grain of both the varieties is reddish black in colour and is not marketable. The stalks when dried do not assume the pale, yellow colour of the ordinary juar stalks, and the cattle I found did not care much for it. But it is an excellent green fodder. The stems of both varieties when green seem to be sweeter than the ordinary juar. In my opinion they could be used for the extraction of sugar.

18. Seven different varieties of cotton were grown and sent to the Manager, Empress Mills, Nagpur, for opinion and valuation. His report is as follows:—

"*Jari*.—The jari has the average length staple, but has a yellow tinge. Value Rs.47 per *boja*.

Bani.—Bani is the best and superior in uniformity of staple. Value Rs.70 per *boja*.

Nimari.—Nimari is the best, has a softer feel than Hinganghat ; but the staple is not so strong. Value Rs.70 per *boja*.

Garo-Hill.—Has a shorter staple than jari, inferior in colour and strength also to the latter, and value Rs.45 per *boja*.

Upland-Georgian.—Looks inferior to the Hinganghat and Nimari cotton. It has an admixture of short staple, and we value it at Rs.67 per *boja*.

Tree cotton.—The tree cotton is not so soft in feel as Hinganghat cotton, has a yellow taint and mixed staple. Value Rs.67 per *boja*.

Cairo cotton.—The Cairo has a mixture of white and brown staple, shorter than middling Egyptian. Value Rs.85 per *boja*."

19. In Field No. 39 Jaunpur and Horsetooth Maize were sown. It is found very difficult to protect the crop from the ravages of jackals.

The seed of both varieties is kept for distribution. The crop gave as good a yield as last year.

20. Sorghum Halipense has established itself in a patch of ground far away from the cultivated fields, and I am collecting seed and extending its cultivation.

21. Three varieties of rice were sown, *viz* :—Chinoor, Halva and Bhadgonda. The yield was fair ; but the outturn of the fields on the *nala* side was very poor, as much of the seed was washed away by the floods.

IX.—EXPERIMENT WITH PLANT DISEASES.

22. The experiment of soaking juar seed in a solution of cupric sulphate before sowing as a preventive against the attacks of smut (*Ustilago carbo*) was a complete success. Not a single ear of juar was found affected with the disease.

Plaint Diseases.

23. A field was allotted for the cultivation of fourteen different varieties of wheat in order to ascertain which particular variety is liable to rust, and which of them is rust-resistant.

I.—Katha	...	} Local varieties.
II.—Haura	...	
III.—Pissi	...	
IV.—Muzaffarnagar Pissi	...	Acclimatized seed originally imported from N.-W. P.
V.—Bold Hard yellow	...	Acclimatized seed originally received from Harda.
VI.—Bansi	...	{ Acclimatized seed originally received from Hoshangabad.
VII.—Jondhala or Dhana	...	
VIII.—Mundiapissi	...	{ Acclimatized seed originally received from Messrs. Ralli Brothers' agency, Harda.
IX.—Mundiapissi	...	
X.—Mundiapissi	...	Acclimatized seed originally received from Hoshangabad.
XI.—American wheat	...	Acclimatized seed originally received from Jubbulpore.
	...	{ Acclimatized seed originally received from Cawnpore which had received it from Bundelkhand.
	...	

- XII.—Australian wheat ... Acclimatized seed originally received from Australia.
- XIII.—Farrer's wheat No. 32 ... { Acclimatized seed originally received from Mr. Farrer, Australia.
- XIV.—Hybridized haura wheat... Acclimatized seed.

The absence of rust in the year under report prevents any conclusions being drawn from the experiment.

24. The wheat selected from Mr. Farrer's, different varieties of wheat (early and late) referred to in last year's report, were sown again this year. The late varieties did not come to perfection; but from the early varieties a selection has been made to be sown next year.

25. The Hybridized wheat obtained by a cross between Haura and Mundia were sown again this year. The yield is 809 lbs. per acre. The quantity is now sufficient for distribution and sowing. The grain is plump, glossy and marketable, but as stated above I was unable to test its rust-resistant quality in the year under report.

X.—METHODS OF CULTIVATION.

26. Experiments of digging trenches between trees and *rabi* crops in their vicinity in order to save the latter from the loss of moisture otherwise absorbed by the surface roots of the trees, were continued with successful results.
- Methods of Cultivation.

XI.—TRIAL OF IMPLEMENTS.

27. All the implements tried last year were given a further trial this year. Two implements were tried during the year under report. They were "Martin's future plough of India" and "the Kolar Mission Drag Harrow (clod crusher)." The former is too delicate an implement for our black soil, while the latter is too light to be of much service.
- Implements.

XII.—DISTRIBUTION OF SEEDS AND IMPLEMENTS.

- Distribution of seeds and implements. 28. In the year under report seeds and implements were distributed to the undermentioned gentlemen :—

SEEDS.

Description of seed.	To whom supplied,
Upland Georgian cotton seed ...	Sachram Dina Nath, pleader, Rahuri, district Ahmadnagar.
Several varieties of cotton seed ...	Superintendent, Botanical Gardens, Saharanpur.
Maize seed ...	Manager, Court of Wards, Nagpur.
" " ...	Rev. E. M. Gordon, Mungeli, district Bilaspur.
" " ...	Mr. Vahududin, Vice-President of Deoli Municipality, Wardha district.
" " ...	Mr. Raghoba Ratiram, Vice-President of Saoner Municipality, Nagpur district.
Til seed ...	Mr. Purshotam Lal, pleader, Jubbulpore.
Several varieties of wheat seed ...	Superintendent, Government Veterinary Hospital, Saidapeth.
Maize, juar, til, wheat, linseed, &c. ...	Mr. N. G. Mukerji, Professor of Agriculture, C. E. College, Sibpur and Calcutta.

By the order of the Commissioner of Settlements and Agriculture a large quantity of juar seed grown on the Farm was exchanged with the smutted seed of the cultivators of Somalwara.

IMPLEMENTS.

Description of implement.	To whom supplied,
A bakhar and two dauras ...	Director of Land Records and Agriculture, Bengal.
Two Swedish ploughs ...	Mr. Panda Baijnath, Tahsildar, Khurai, district Saugor.
One Swedish plough ...	Mr. Nathuram Singai of Nowgaon, district Saugor.
Two Swedish ploughs ...	Deputy Commissioner, Saugor.

XIII.—CATTLE-BREEDING.

- Cattle-breeding. 29. The Mysore bull kept at the Farm has now become too old for breeding purposes, but continues to be worked on the Farm in drawing the plough.

XIV.—FODDER AND FOREST RESERVES AT TELANKHERI.

- Fodder and Forest. 30. Some mischievous person set the grass on fire one evening, which caused great damage to the young plants in the Reserve. The extent of the damage will be ascertained later on when the monsoon sets in as it will then only be seen how many of the trees injured by the fire will shoot out again.

The Farm and Gardens continue to draw their supply of grass from the Reserve. The receipts and expenditure of the Reserve are as follows :—

<i>Expenditure.</i>					Rs. a. p.
Pay of 2 chowkidars in 1898-99	...	...	...	...	139 0 0
<i>Receipts.</i>					
(1) Value of grass supplied to the Farm and Garden	...	...	...	...	120 0 0
(2) Do. do. sold by auction	...	...	...	...	120 0 0
					<hr/> 240 0 0
Deduct cost of establishment	...	...	...	...	139 0 0
					<hr/>
				Net profit Rs.	101 0 0
					<hr/>

XV.—SEWAGE FARM.

- Sewage Farm. 31. There is nothing new or noteworthy to be mentioned about this institution in the year under report. The Kachis' leases have expired and new leases for three years have been given to them.

XVI.—AGRICULTURAL CLASS.

- Agricultural Class. 32. The working of the Agricultural Class has been separately reported upon. The year opened with four senior students. Of these 4, 3 appeared for Final Examination and one was chosen for deputation to the Science College, Poona, with the object of prosecuting his studies there for a term of three years during which period he will receive a Scholarship of Rs.20 per mensem. Eleven new students joined the junior class, of whom two were F. A's. and nine were Matriculates.

The school has now been closed to all but matriculates subject to any special exception. Practical field work was as usual insisted upon. The senior students cultivated both kharif and *rabi* crops on the half acre plots allotted to them, and the juniors cultivated only *rabi* crops on their quarter acre plots. The total area under cultivation was 4.75 acres, and the students realized Rs.40-2-0 by the sale of their crops, each one appropriating the value of the produce of his own plot.

The Annual Examination papers were set by the gentlemen mentioned in the last year's report. I examined the students in practical agriculture. Three senior and ten junior students passed the Final and Annual Examinations. Prem Narayan, who stood first on the list of successful candidates of the senior class, secured the silver medal. All the ten junior students who passed the 1st year's course were promoted to the second year's course.

33. Both the classes of the Normal Agriculture Class were opened in June 1898. The first batch consisted of 58 schoolmasters who all appeared for the Final Examination held on 30th October 1898. Out of the 58 masters, who appeared for the examination, 52 passed the prescribed test and obtained certificates. The second Session of the class opened in November 1898 with 70 students. Out of these, 33 were schoolmasters selected from different districts and 37 ex-students of the Jubbulpore, Nagpur and Raipur Normal Schools. Out of 70 students, 66 appeared for the examination held on the 26th March 1899; 57 duly passed the prescribed test and obtained certificates.

XVII.—MISCELLANEOUS.

34. During the year under report a collection of Botanical specimens with seed of *Andropogon Sorghum* (Juar) and seeds of *Cassia Tora* was undertaken for the Reporter on Economic Products to the Government of India.

35. Under instructions from the Commissioner of Settlements and Agriculture, Central Provinces, I proceeded to Saugor in September 1898 with the object of conducting some experiments in extirpating the Kans (*Saccharum spontaneum*) in the Saugor district.

Three Swedish ploughs were sent to the Deputy Commissioner a few days before my arrival, and I found that deep ploughing with strong cattle with a body of labourers to pluck up the upturned roots was of some efficacy.

XVIII.—FINANCIAL RESULTS.

36. The expenditure and receipts of the year are shown below :—

				EXPENDITURE.			Receipts.	Net cost										
				Salaries.	Contingencies.	Total.												
				Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.						
Budget	4,824	0	0	*4,276	0	0	9,100	0	0	2,050	0	0	7,050	0	0
Actual	4,225	3	6	2,156	1	10	6,381	5	4	3,041	3	8	3,340	1	8

* Excluding Rs.400 transferred to Horticultural Gardens, Nagpur.

A detailed statement showing the various items of receipts and expenditure is printed as Annexure D. The figures are contrasted with those of 1897-98.

37. During the year I was ably assisted by the Farm Overseer, and your predecessor was pleased to grant him a rise in pay.

I have the honour to be,

SIR.

Your most obedient servant,

R. S. JOSHI,

Supdt., Govt. Experimental Farm, Nagpur.

LIST OF ANNEXURES.

- A.—Statement showing the total areas under cultivation on the Experimental Farm, Nagpur, during 1898-99.
 - B.—Statement showing the average rates of the cost of cultivation on the Experimental Farm, Nagpur, 1898-99.
 - C.—Statement showing the rates used for valuing the produce of the Experimental Farm, Nagpur, during 1898-99.
 - D.—Statement showing the comparison of receipts and expenditure of 1898-99 with that of 1897-98.
 - E.—Programme of experiments as it stood on the 1st June 1899.
 - F.—Inspection note on the Nagpur Experimental Farm, by Dr. J. W. Leather, Assistant Agricultural Chemist to the Government of India.
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Annexure A.

Total area under cultivation on the Experimental Farm, Nagpur, during the year 1898-99

Crop.						Area.	Total.	Grand Total.
						Acres.	Acres.	Acres.
A.—EXPERIMENTAL AREA.								
(1) <i>Kharif</i> —								
Cotton alone ..	...	...	...	...	...	4'93		
Cotton and tur	...	...	...	...	...	'57		
Cotton and juar	...	...	...	...	...	'27		
Juar	...	...	...	...	...	2'61		
Tur	...	...	...	...	...	'20		
Paddy	...	...	...	...	...	1'33		
Maize	...	...	...	...	...	'60		
Sorghum	...	...	...	...	...	'18		
Bajara	...	...	...	...	...	'46		
Til	...	...	...	...	...	'65		
(2) <i>Rabi</i> —							11'80	
Wheat	...	...	...	...	...	11'60		
Wheat and gram	...	...	...	...	...	'21		
Gram	...	...	...	...	...	'30		
Linseed	...	...	...	...	...	2'97		
Mustard	...	...	...	...	...	'80		
Safflower	...	...	...	...	...	'70		
B.—NON-EXPERIMENTAL AREA.							16'58	28'38
(1) <i>Kharif</i> —								
Cotton	...	...	...	...	...	1'93		
Paddy	...	...	...	...	...	1'99		
Tur	...	...	...	...	...	14'76		
Coriander	...	...	...	...	...	'90		
Mundia	...	...	...	...	...	'25		
Mote	...	...	...	...	...	'46		
Til	...	...	...	...	...	'77		
Castor	...	...	...	...	...	2'69		
(2) <i>Rabi</i> —							23'75	
Wheat	...	...	...	...	...	6'67		
Gram	...	...	...	...	...	4'02		
Lakh	...	...	...	...	...	1'08		
Linseed	...	...	...	...	...	2'93		
Safflower	...	...	...	...	...	3'22	17'92	41'67
GRAND TOTAL						...	...	70'05

Annexure B.

Statement showing the average cost per acre of each operation of cultivation on the Experimental Farm, Nagpur, during the year 1898-99, as deduced from the Field Cultivation Book.

[NOTE.—The hire of a pair of bullocks is taken as 12 annas; of a male cooly, 3 annas; of a female cooly, 1½ annas and of a child 1 anna.]

Class of operation.	Detail.	Rate per acre.	Explanation.
		Rs. a. p.	
Cost of tillage	Ploughing by Swedish plough ...	1 13 5	A pair of bullocks and a man for 1'96 day.
	Hoeing by bakhar (bullock hoe) ...	0 14 10	Do. do. for '98 day.
	Weed hoeing by daura (small bullock weeding hoe) ...	0 7 5	Do. and two men for '41 day.
	Weed hoeing by dundia (large bullock weeding hoe) ...	0 7 3	Do. do. for '40 day.
	Weeding by hand ...	1 0 11	10 women for 1'12 day.
Cost of sowing including cost of seed.	Cotton by argarha (country drill hoe)	1 1 2	16lbs. of seed (Re.0-3-3). A pair of bullocks and a man and 3 women for '71 day.
	Tur by do. ...	0 11 7	17lbs. of seed (Re.0-7-1). A pair of bullocks and a man and 3 women for '23 day.
	Juar by tifar (country drill)	0 13 5	14lbs. of seed (Re.0-5-9). A pair of bullocks and 2 men for '42 day.
	Gram by nari-nager (drill plough) ...	3 8 4	40lbs. of seed (Re.1-3-8). A pair of bullocks and 2 men for 2 03 days.
	Linseed by tifar (country drill) ...	1 12 3	13lbs. of seed (Re.0-10-10). Two pairs of bullocks and 3 men for '52 day.
	Wheat by nari-nager (drill plough) ...	5 1 2	100lbs. of seed (Rs.4-8-0). One pair of bullocks and 2 men for '51 day.
Cost of manure (excluding loading, carting and spreading).	Saltpetre ...	13 2 0	240lbs. @ Rs.4-6-0 per maund.
	Bone-dust ...	3 6 0	360lbs; cost of collecting 8 annas per maund and of crushing 4 annas per maund.
	Cattle-dung ...	10 0 0	160 maunds @ 1 anna per maund.
	Ashes of dung ...	11 0 8	160 maunds dung @ 1 anna per maund and drying and burning dung ashes, Re.1-0-8 per acre.
	Green-manuring with san-hemp ...	9 13 6	100lbs. of seed (Rs.3-12-0); sowing broad-cast (Re.0-1-8); covering seed by harrow (Re.0-8-4); cutting and ploughing (Re.5-7-6).
	Do. with kadooljira (<i>Veronica cinerea</i>) ...	10 15 7	Cutting and carting kadooljira (Rs.7-3-7); ploughing (Rs.3-12-0).
Cost of harvesting.	Picking cotton ...	0 11 5	2 women for 3'80 days each picking.
	Reaping juar ...	1 5 0	8 do. 1'75 day.
	Do. gram ...	0 4 2	7 do. '39 day.
	Do. linseed ...	0 6 10	5 do. '91 day.
	Do. wheat ...	0 7 2	4 do. 1'19 day.
Cost of threshing and cleaning.	Ginning cotton ...	2 1 10	2 men and 1 woman for 4'51 days; average produce per acre, 362lbs. of seed cotton.
	Threshing and cleaning juar ...	0 12 4	1 man and 1 woman for 2'74 days; average produce per acre, 330lbs. of grain and 1,026lbs. of karbi.
	Do. gram ...	0 11 4	4 bullocks, 1 man, 2 women and 2 boys for '35 day; average produce per acre 251lbs. of grain and 331lbs. of chaff.
	Do. linseed ...	1 3 11	4 bullocks, 1 man, 2 women and 2 boys for '62 day; average produce per acre, 85lbs. of seed and 231lbs. of stalks.
	Do. wheat ...	1 13 6	4 bullocks, 1 man, 3 women and 2 boys for '88 day; average produce per acre, 363lbs. of grain and 563lbs. of straw.

Annexure C.

Statement showing the Rates used for valuing the produce of the Experimental Farm, Nagpur, during the year 1898-99.

Name of produce.				VALUE.		Remarks.
				Rate.	Per.	
				Rs. a. p.		
Cotton lint (according to quality)	...	{		70 0 0	Bojha of 345lbs.	
				67 0 0		
				47 0 0		
				45 0 0		
Cotton seed ...	...	...	...	7 1 0	Khandi of 640lbs.	
Juar ...	{	Grain ...	...	8 0 0	Khandi of 390lbs.	
		Karbi ...	...	25 0 0	Poolas 1,000	... About 3,460lbs.
Tur ...	{	Grain ...	...	7 8 0	Khandi of 421lbs.	
		Stalks ...	...	0 12 0	8 bundles	... About 560lbs.
		Bhusa ...	...	1 8 0	One cart-load	... About 478lbs.
Gram ...	{	Grain ...	...	9 10 0	Khandi of 390lbs.	
		Chaff ...	...	1 8 0	One cart-load	... About 478lbs.
Linseed (chaval-katha)...	{	Seed ...	...	18 8 0	Khandi of 385lbs.	
		Stalks and bhusa ...	...	1 8 0	One cart-load	... About 478lbs.
Wheat (haura)—Nagpur	{	Grain ...	...	14 8 0	Khandi of 400lbs.	
		Straw ...	...	1 12 0	One cart-load	... About 478lbs.

Annexure D.

Statement showing the details of Receipts and Expenditure of the Experimental Farm, Nagpur, during the year 1898-99.

Receipts.	1897-98.	1898-99.	Remarks.	Expenditure.	1897-98.	1898-99.	Remarks.
Commercial sale of produce	Rs. a. p.	Rs. a. p.		Purchase of seeds and plants	3 4 2	1 14 0	
Distribution { Seeds	834 1 8	900 5 1		Repairs of premises	472 12 6	10 0 0	
... { Implements	66 6 9	8 4 0		Postage	5 0 0	10 4 0	
Rent of Government land	...	57 5 1		Service telegrams	...	...
Sewage Farm	886 13 7	850 3 2		Country stationery	0 9 6	0 2 6	
Miscellaneous	748 13 9	741 13 0		Purchase of books	...	...
	605 5 0	483 5 4		Do. cattle	225 0 0	200 0 0	
				Do. implements	547 0 9	100 5 6	
				Repairs of tools and plants	25 11 3	141 15 3	
				Feed and care of cattle	356 3 8	161 8 0	
				Irrigation	...	4 12 0	
				Manure	50 2 6	51 7 6	
				Variable labours, agricultural	192 14 3	181 2 10	
				Do. cartwork, &c.	...	...
				Packing and freight	95 14 9	66 6 9	
				Sewage Farm	935 7 10	950 13 0	
				Binding charges	2 4 0	1 0 0	
				Other miscellaneous charges	76 4 0	125 14 6	
				Total	2,988 9 2	2,010 9 10	
				Establishment	4,185 9 5	4,225 3 6	
				Total	4,185 9 5	4,225 3 6	
				Travelling allowance of Superintendent	113 12 0	145 8 0	
				Total	113 12 0	145 8 0	
GRAND TOTAL	3 141 5 9	3 011 3 8		GRAND TOTAL	7 287 14 7	6 381 5 4	

Repairs to five ploughs of Swedish pattern.

Annexure E.
EXPERIMENTAL FARM, NAGPUR.
Programme of Experiments as it stood on the 1st June 1899.

No. of field.	Purpose of Experiment.	Crop.			SPECIAL TREATMENT.			Year (commencing June) in which experiment started	Remarks.
		1st year.	2nd year.	3rd year.	1st year.	2nd year.	3rd year.		
A.—1 —2 —3 —4 —5 —6 —7 —8	Effect on wheat grown continuously of different kinds of manures applied year after year with irrigation.	Wheat	Wheat	Wheat	Manure Experiments.			1893	Cropping and treatment similar every year: Quantities per acre: Saltpetre, 240 lbs. Bone dust, 360 lbs. Cattle-dung, 160 mds. Ashes of 160 mds. of dung.
		Do.	Do.	Do.	Saltpetre	Same as in 1st year	Same as in 1st year		
		Do.	Do.	Do.	Bone-dust	Do.	Do.		
		Do.	Do.	Do.	Saltpetre and bone-dust...	Do.	Do.		
		Do.	Do.	Do.	Cattle-dung	Do.	Do.		
		Do.	Do.	Do.	Dung and bone-dust	Do.	Do.		
		Do.	Do.	Do.	Ashes of dung	Do.	Do.		
		Do.	Do.	Do.	<i>Nil</i>	Do.	Do.		
B.—1 —2 —3 —4 —5 —6 —7 —8	Do. without irrigation ...	Wheat	Wheat	Wheat	Saltpetre	Same as in 1st year	Same as in 1st year	1890	Do.
		Do.	Do.	Do.	Bone dust	Do.	Do.		
		Do.	Do.	Do.	Saltpetre and bone-dust...	Do.	Do.		
		Do.	Do.	Do.	Cattle-dung	Do.	Do.		
		Do.	Do.	Do.	Dung and bone-dust	Do.	Do.		
		Do.	Do.	Do.	Ashes of dung	Do.	Do.		
		Do.	Do.	Do.	<i>Nil</i>	Do.	Do.		
		Do.	Do.	Do.	Sal-hemp ploughed in green.	Do.	Do.		
Vile.—1 —2 —3 —4 —5 —6	Practical method of soil analysis by using chemical manures, as devised by M. Georges Ville.	Wheat	Wheat	Wheat	Amm. chlor. cal. super-phos: pot. sulph. and cal. sulph.	Same as in 1st year	Same as in 1st year	1899	Cropping and treatment similar every year. Quantities per acre: Amm. Chlor., 140lbs. Cal. superphos 180lbs. Pot. sulphate, 90lbs. Cal. do. 100lbs.
		Do.	Do.	Do.	As in 1 less cal. super-phos.	Do.	Do.		
		Do.	Do.	Do.	As in 1 less Amm. chlor.	Do.	Do.		
		Do.	Do.	Do.	No manure.	Do.	Do.		
		Do.	Do.	Do.	As in 1 less potassic sulphate.	Do.	Do.		
		Do.	Do.	Do.	As in 1 less cal. sulphite	Do.	Do.		
		Do.	Do.	Do.	<i>Psoralea</i> to be ploughed in green.	Same as in 1st year	Same as in 1st year.		
		Wheat	Wheat	Wheat	<i>Box dung</i>	Do.	Do.		
18.—1 —2 —3 —4	Relative effect of green-manuring, box-dung and stall-dung.	Do.	Do.	Do.	<i>Stall-dung</i>	Do.	Do.	1890	Cropping and treatment similar every year.
		Do.	Do.	Do.		Do.	Do.		
		Do.	Do.	Do.		Do.	Do.		
		Do.	Do.	Do.		Do.	Do.		

32-1	Effect on wheat of green-manuring with <i>Psoralea coriifolia</i> .	Wheat	Wheat	Wheat	Wheat	Green-manuring with weeds cut from waste land. Nil	Same as in 1st year	Same as in 1st year	1891	Do.
23-1	Effect on wheat of manuring with saltpetre in different rates per acre without irrigation.	Do.	Do.	Do.	Do.	Saltpetre, 24lbs. per acre	Same as in 1st year	Same as in 1st year	1896	Do.
68-1	Do. with irrigation	Do.	Do.	Do.	Do.	Saltpetre, 24lbs. per acre	Same as in 1st year	Same as in 1st year	1896	Do.
15-1	To test the effect of manuring at different times of the year.	Wheat	Wheat	Wheat	Wheat	Manured with dung on June 1st, Do. in July end.	Same as in 1st year	Same as in 1st year	1896	Do.
55-1	Do. do.	Wheat	Wheat	Wheat	Wheat	Manured with dung on June 1st, Do. in July end.	Same as in 1st year	Same as in 1st year	1897	Do.
9-1	To test the effect of phosphatic manures on different oil seeds suggested by Dr. Leather.	Linseed and Mustard	Linseed and Mustard	Linseed and Mustard	Linseed and Mustard	Saltpetre	Same as in 1st year	Same as in 1st year	1896	Treatment similar every year.
59-1	Do. do.	Til and Kardi	Til and Kardi	Til and Kardi	Til and Kardi	Saltpetre	Same as in 1st year	Same as in 1st year	1896	Do.
29-1	Effect of rotations with wheat	Wheat	Wheat	Wheat	Wheat	Saltpetre	Same as in 1st year	Same as in 1st year	1890	Two year rotation, i.e., the fourth year will follow the second.
57-1	Do. with linseed	Linseed	Linseed	Linseed	Linseed	Saltpetre	Same as in 1st year	Same as in 1st year	1890	Do. and green-manuring with coriander in year of linseed.

Annexure E.—(concl'd.)

No of field.	Purpose of Experiment.	CROP.			SPECIAL TREATMENT.			Year (commencing June) in which experiment started.	Remarks.
		1st year.	2nd year.	3rd year.	1st year.	2nd year.	3rd year.		
61-1 —2 —3	Effect of rotations with cotton ...	Cotton and tur Do. Do.	Cotton and tur Wheat Gram	Cotton and tur Do. Do.	Nil Do. Do.	Nil Do. Do.	Nil Do. Do.	1893 ..	Two year rotation, i.e., the fourth year will follow the second.
63-1 —2 —3 —4	Effect of green manuring with san-hemp. { On wheat with fallow interposed, wheat in rotation with cotton.	Fallow Do. Wheat Do.	Wheat Do. Cotton Do.	Fallow Do. Wheat Do.	Green-manuring with san-hemp. Nil Green-manuring with san-hemp. Nil	Nil Do. Do. Do.	Green-manuring with san-hemp. Nil Green-manuring with san-hemp. Nil	1899 ..	Cropping and treatment similar every year.
17-1 —2	Effect on wheat and cotton in rotation of green manuring with papilionaceous weeds (<i>Psoralea carthagenica</i>).	Wheat Do.	Cotton Do.	Wheat Do.	Green-manuring with weeds cut from waste land. Nil	Nil Do.	Green-manuring with weeds cut from waste land. Nil	1890 ..	Do.
44-1 —2 —3 —4	Relative effect on cotton and wheat in rotation of box-dung, stall-dung and bone-dust.	Cotton Do. Do. Do.	Wheat Do. Do. Do.	Cotton Do. Do. Do.	Stall-dung Box-dung Bone-dust	Same as in 1st year Do. Do. Do.	Same as in 1st year Do. Do. Do.	1890 ..	Manures continued every year, crop to be in rotation.
42 N-N. —1 —2 —3 —4	To test the effect of potassic and phosphatic manures on tur and wheat grown in rotation.	Tur Do.	Wheat Do.	Tur Do.	Powdered bones and potassic sulphate Nil	Nil Do.	Powdered bones and potassic sulphate Nil	1896 ..	Crop to be in rotation.
55-3 —4 —5	Effect of mixing crops, the principal one being cotton.	Cotton. Cotton and tur in proportion of 6 lines to 2, cotton and tur in the proportion of 6 lines to 2.	Same as in first year. Do. Do.	Same as in first year. Do. Do.	Nil Do. Do.	Nil Do. Do.	Nil Do. Do.	1895 ..	Cropping similar every year. Manure to be applied occasionally.

25-1	Effect of mixing crops, wheat and a leguminous crop gram.	Wheat	...	Same as in 1st year.	...	Nil	...	Nil	...	1890	...	Do.
25-2		Wheat and gram	...	Do.	...	Do.	...	Do.	...	...	...	...
Experiments with Tillage.												
21-1	Effect of tillage to various depths	Wheat	...	Wheat	...	To be ploughed every year.	...	Same as in 1st year	...	Same as in 1st year	...	Cropping and treatment similar every year.
21-2		Do.	...	Do.	...	To be hoed (bakhared) every year.	...	Do.	...	Do.	...	
21-3		Do.	...	Do.	...	To be ploughed and bakhared in alternate years.	...	Do.	...	Do.	...	
22-1		Wheat	...	Wheat	...	To be ploughed every year.	...	Same as in 1st year	...	Same as in 1st year	...	
22-2		Do.	...	Do.	...	To be hoed (bakhared) every year.	...	Do.	...	Do.	...	
22-3	Do.	Do.	...	Do.	...	To be ploughed and bakhared in alternate years.	...	Do.	...	Do.	...	
33-1	Do.	Wheat	...	Wheat	...	To be hoed (bakhared) every year.	...	Same as in 1st year	...	Same as in 1st year	...	Do.
33-2		Do.	...	Do.	...	To be ploughed with country plough and bakhared in alternate years.	...	Do.	...	Do.	...	
33-3		Do.	Do.	...	Do.	...	To be ploughed every year with Swedish plough.	...	Do.	...	Do.	...
Experiments with selection of Seed.												
40-1	Effect of selection of seed	Wheat	...	Wheat	...	Selected seed	...	Same as in 1st year	...	Same as in 1st year	...	Do.
40-2		Do.	...	Do.	...	Unselected seed	...	Do.	...	Do.	...	...
Variety of Crops.												
41 & 43	To test the rust-proof property of different kinds of wheat.	Wheat	...	Wheat	...	Kachera manure	...	Same as in 1st year	...	Same as in 1st year	...	Do.
39		Wheat	...	Wheat	...	Kachera manure	...	Same as in 1st year	...	Same as in 1st year	...	Do.
Experiments in manuring fields on the Meagher system.												
50N	Effect of manuring fields on Meagher system.	Juar	...	Same as in 1st year.	...	Sewage manure	...	Sewage manure	...	Sewage manure	...	...
66W		Do.	...	Do.	...	Do.	...	Do.	...	Do.	...	
62		Do.	...	Do.	...	Do.	...	Do.	...	Do.	...	
64		Do.	...	Do.	...	Do.	...	Do.	...	Do.	...	

Annexure F.

Inspection Note of the Nagpur Farm.

I visited the Nagpur Farm on November 10th-11th and went over it carefully with Mr. Joshi, the Superintendent. We were also accompanied by Mr. Carey on 10th.

Regarding the experiments the following comments may be made :—

2. *Series A and Series B.*—This experiment should remain intact for the present. It cannot well be improved by alteration.

3. *Series C.*—This experiment, wherein the effect of various manures is tested for linseed on the same lines as for wheat in series *A* and *B*, had better be closed. The crops of linseed have gradually diminished year by year, and it is merely demonstrating what has been shown in other experiments on the linseed crop, that one cannot grow it successfully year by year on the same land. Thus the correctness of the ryot's practice is verified.

4. Experiments in Fields Nos. 18, 32, 23 and 68, on effects of certain manures for wheat, may advantageously remain unaltered. Their object is similar to the *A* and *B* series, and the results are in most cases comparable. The experiment in Field No. 68 has given irregular results, but I understand from Mr. Joshi that the saltpetre, now that it is applied at an earlier stage of growth, is making its effect more pronounced. The principal value of these experiments on manures for wheat is that they may be compared with those obtained at Cawnpore. At the same time, as I shall mention in a subsequent paragraph, I am of opinion that, for some reason, the soil of this Farm (or the climate) is adverse to the successful growth of wheat. The yields of wheat have been decidedly low during the last few years.

5. The experiments in Fields Nos. 15 and 22, on the relative value of applying Farm manure at different periods in the monsoon for a succeeding wheat crop, have not proved anything. The yields have been unusually low, and, however valuable the experiment is in principle, it seems hopeless to attempt to carry it out on these fields.

6. *The Ville Series.*—This experiment, which is continued as an object lesson for the students, is intended to illustrate the value of different plant foods for crops. Formerly wheat was grown. Since we knew how the several plant foods affected this crop, I suggested, in 1894, that linseed, the requirements of which crop have not been sufficiently studied, might be substituted. But in this experiment, as in others, where linseed is grown continuously on the same land, it has demonstrated that the practice is at fault, and that linseed cannot be successfully grown uninterruptedly on the same land. The experiments had better be continued on *wheat* instead of linseed.

7. The experiment in Field No. 55, on the effect of green manures for wheat, has but little value. We have plots in three other experiments which are manured for wheat in this manner, and, moreover, there is no *unmanured* plot with which to compare the effect of the green manures.

8. The experiment on the value of phosphates for various oil-seed crops in Fields Nos. 9 and 59 was only commenced in 1896, and it is too early to pass an opinion upon it. So far the results have certainly been discouraging. But here, again, as in some of the other experiments, the irregularities appear to be due in a great measure to the land. For example, this year when I visited the Farm, Plot No. 2 in Field No. 9 has, far and away, the best crops of both the oil-seeds, til and khadi. This plot has been manured with saltpetre, but it should not (in so far as the manures are concerned) have been very different from Plot No. 5, which was manured with the same amount of saltpetre and bones in addition.

9. The other experiment with manure deserves notice, namely, Lieutenant Meagher's system of applying night-soil, which I brought to the notice of the Commissioner of Settlements and Agriculture in 1894. This is the third year that it has been experimented with at Nagpur, and it has proved a very great success. The crops are magnificent. It must not be forgotten, however, that the actual amount of manure applied is very considerable. It will be of interest to notice for how long a period the effects of the manure are maintained.

10. *The Rotation Experiments.*—The principle of the experiments in Fields Nos. 29, 57 and 61 is the alternate growth of non-leguminous crops and leguminosæ. The rotations consist of (a) wheat and gram and wheat and tur (and juar), (b) linseed and gram and linseed and tur, and (c) cotton and tur. The plan of the experiments is not so simple as the above indicates, for other crops are also grown on the same plots, in some cases with the

leguminosæ, in some cases alone. But here, again, the yields appear to be very small throughout the series. The wheat yield has decreased, the linseed has practically refused to grow, and the outturns of all the crops in Field No. 61 are decidedly poor. Tur also is suffering in several of the fields of the Farm from a disease which I have not met with elsewhere.

11. The rotation experiments in Fields Nos. 14 and 17, in which there is also included the effect of manures, are, in my opinion, too complicated for successful field experiments. Judging by the results of the first five years' averages, green-manuring with either san-hemp or *bawachi*, has not proved very advantageous. This practically substantiates the results obtained on other plots where this method has been tested. Generally there has been an increased yield, but it has been uniformly a small one. In the case of these experiments it is to be noted that the yield of wheat has decreased materially during the last few years.

12. The experiment on the effect of lime in Field No. 65 has proved of no value, and this is in accord with the fact that the soil contains 1—8 per cent. of lime (Ca.O.) of which one-third exists as carbonate. This land does not stand in need of lime.

13. The experiments in Fields Nos. 25 and 55, to test the value of mixtures of crops, are, in my opinion, worthless. At the best they only indicate what such mixtures yield on the Farm land, and, since there is reason to believe that several of the crops grown do not do well on this land, their continuance only adds unreliable figures to the Annual Report.

14. *Experiments with varieties of Crops.*—I have discussed the subject of testing varieties of crops with Mr. Carey and Mr. Joshi. In para. 137 of my "Final Report" to the Government of India, dated November 1st, 1897, I have referred, at some length, to the question of examination of varieties of crops. In brief, I may repeat here that, in my opinion, there is no branch of agricultural work, which might lead to more valuable results for the ryot, than the systematic examination of the varieties of crops which are grown, in order to determine their relative merits. At the Nagpur Farm a good deal of work has been done for some years on this subject, and Mr. Joshi deserves no small credit for the manner in which he has patiently attempted to obtain, by cross-breeding, a wheat which is more rust-proof than the Central Provinces, and other varieties which he has collected from various sources. The experiments with cottons, after so many years of trial, leave us very much as we were at the commencement. Good varieties are obtainable, but, for some reason, the ryot won't cultivate them.

15. But generally what seems to me to be of so much importance is the more systematic examination of the varieties of the crops which are at present cultivated. We know far too little of these, and I feel certain that if the work were restricted to the thorough examination of one crop at a time, and thereby make a collection of all its varieties in the one Province and obtain clear information as to the conditions under which each variety is cultivated and the particular purposes to which it is put, it would be infinitely better than merely to grow such varieties of diverse crops as are met with in a somewhat hap-hazard manner.

16. The case of the Central Provinces wheat crop is an example. Only three varieties have been grown at the Farm. Do they represent all the varieties which are cultivated in the Province? On this point we have no information and, to my mind, it is of the greatest importance to get it. This crop is certainly one of the most valuable. After rice it ranks as the most extensively cultivated. In some districts it occupies 16—18 per cent. of the cultivated area, and in one (Hoshangabad) 35 per cent. of the arable land bears wheat. Moreover, the crop has repeatedly suffered from very serious attacks of rust, for which there is at present no known cure. Some varieties are, however, known to be much more susceptible to the disease than others. It is therefore obviously necessary to determine whether some of the local varieties are fairly rust-resistant or not. If all varieties are found liable to be seriously attacked, then we must go elsewhere for the desired seed. I may mention that at the Dumraon Experimental Farm three of the Central Provinces varieties were grown alongside others including some from the Punjab, and there at least the difference was striking, for, although they were not years in which any wheat was seriously attacked, the Central Provinces varieties were all attacked more seriously than the Punjab varieties.

17. In order to carry out the systematic examination of any crop, help from each district is naturally essential. Qualified aid is at present not readily obtainable. But I believe that those of the passed students of the Nagpur Agricultural School, who are employed in the districts for other purposes, would be able to render most valuable assistance. Last year, at my suggestion, a memorandum on the sugarcane crop was circulated to some of the ex-students of the Cawnpore School, and they were requested to gather information about the varieties grown in their districts during the cold weather. Some very interesting notes have been submitted. At first one must not expect too much and the students require checking, but, if these men were given annually some such enquiry as this, the Director of Agriculture would eventually have the expert agency without which such agricultural enquiry cannot be carried on at all.

18. In conclusion, regarding the Nagpur Farm, my recent visit only tends to confirm an opinion which has gradually forced itself upon me, namely, that the site is not suited to exact field experiments. Leaving out of the question the experiments on manures, and considering its value for varieties only, it seems to me that it would be a most risky thing to test varieties on many of the plots. The growth of wheat is most erratic and in some cases certainly the later crops have been ridiculously small. Moreover, tur and linseed are unquestionably suffering from disease. If, for example, any serious attempt is to be made to examine varieties of wheat, we should arrive at very questionable results on this land. I have not made any extensive tour in the Central Provinces, and cannot offer a qualified opinion as to what would be a more suitable locality, but I would prefer one somewhat further north than Nagpur.

19. For the present and until some more suitable site be found, I would recommend that on all those plots which are not required for the manure and other experiments which are to be continued, other crops, such as juar, be grown, and wheat, linseed and tur avoided for several years at least. In this way the land would get a thorough change.

